LSF Installation Guide

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Platform Computing Corporation

LSF Installation Guide

Revision Information for the LSF Installation Guide

Edition	Description
First	This document describes LSF 3.1, and is based on Chapters 1 through 3 of the *LSF Administrator's Guide*, fourth Edition.
Second	Revised for LSF version 3.2.

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Audience

This guide describes the installation of LSF products. In it, you will find all the information you need to install and set up LSF at your site. This guide assumes you have knowledge of common system administration tasks such as exporting and mounting Network File System (NFS) partitions.

This guide has been designed to help LSF administrators install an LSF product, add a host to a cluster, manage LSF licensing, upgrade LSF, and perform any installation or initial setup tasks for LSF products.

LSF Suite 3.2

LSF is a suite of workload management products including the following:

LSF Batch is a batch job processing system for distributed and heterogeneous environments, which ensures optimal resource sharing.

LSF JobScheduler is a distributed production job scheduler that integrates heterogeneous servers into a virtual mainframe or virtual supercomputer

LSF MultiCluster supports resource sharing among multiple clusters of computers using LSF products, while maintaining resource ownership and cluster autonomy.

LSF Analyzer is a graphical tool for comprehensive workload data analysis. It processes cluster-wide job logs from LSF Batch and LSF JobScheduler to produce

statistical reports on the usage of system resources by users on different hosts through various queues.

LSF Parallel is a software product that manages parallel job execution in a production networked environment.

LSF Make is a distributed and parallel Make based on GNU Make that simultaneously dispatches tasks to multiple hosts.

LSF Base is the software upon which all the other LSF products are based. It includes the network servers (LIM and RES), the LSF API, and load sharing tools.

There are two editions of the LSF Suite:

LSF Enterprise Edition

Platform's LSF Enterprise Edition provides a reliable, scalable means for organizations to schedule, analyze, and monitor their distributed workloads across heterogeneous UNIX and Windows NT computing environments. LSF Enterprise Edition includes all the features in LSF Standard Edition (LSF Base and LSF Batch), plus the benefits of LSF Analyzer and LSF MultiCluster.

LSF Standard Edition

The foundation for all LSF products, Platform's Standard Edition consists of two products, LSF Base and LSF Batch. LSF Standard Edition offers users robust load sharing and sophisticated batch scheduling across distributed UNIX and Windows NT computing environments.

Related Documents

The following guides are available from Platform Computing Corporation:

> *LSF Installation Guide*
> *LSF Batch Administrator's Guide*
> *LSF Batch Administrator's Quick Reference*
> *LSF Batch User's Guide*

LSF Batch User's Quick Reference
LSF JobScheduler Administrator's Guide
LSF JobScheduler User's Guide
LSF Analyzer User's Guide
LSF Parallel User's Guide
LSF Programmer's Guide

Online Documentation

- Man pages (accessed with the `man` command) for all commands
- Online help available through the Help menu for the `xlsbatch`, `xbmod`, `xbsub`, `xbalarms`, `xbcal` and `xlsadmin` applications.

Technical Assistance

If you need any technical assistance with LSF, please contact your reseller or Platform Computing's Technical Support Department at the following address:

LSF Technical Support
Platform Computing Corporation
3760 14th Avenue
Markham, Ontario
Canada L3R 3T7

Tel: +1 905 948 8448
Toll-free: 1-87PLATFORM (1-877-528-3676)
Fax: +1 905 948 9975
Electronic mail: *support@platform.com*

Please include the full name of your company.

You may find the answers you need from Platform Computing Corporation's home page on the World Wide Web. Point your browser to *www.platform.com*.

If you have any comments about this document, please send them to the attention of LSF Documentation at the address above, or send email to *doc@platform.com*.

Preface

1. LSF Installation Concepts

This chapter contains background information intended for anyone installing any LSF software product on any platform. These concepts should be read and understood before installing LSF software. Understanding this information will allow you to make the informed decisions that lead to a smooth LSF installation.

LSF Products

The products that make up LSF Suite 3.2 are described in the preface of this book. The LSF products are all packaged in the same distribution file, and the installation program requires you to specify which products are to be installed. LSF Batch is installed by default.

LSF Base is a prerequisite for all other LSF products. LSF Batch is prerequisite for LSF JobScheduler, LSF Analyzer, and LSF Parallel.

Individual hosts can be configured to run as LSF Batch servers or LSF JobScheduler servers within the same cluster. LSF MultiCluster is licensed on a cluster-wide basis i.e. the entire cluster is either enabled or disabled for multicluster operation.

Choosing Hosts for the Cluster

Hosts should be chosen so that users on any host in the cluster have shared access to the computing resources on all hosts. LSF includes sophisticated controls to prevent overloading hosts, so interactive workstations can be configured as LSF servers without degrading performance for the owner.

1 LSF Installation Concepts

LSF works best when users' home directories are shared across all hosts in the cluster by NFS, by the Andrew File System (AFS), or by the Distributed File System (DCE/DFS).

> **NT** On Windows NT systems, users' home directories can be mapped to NT shared directories (on an NTFS file system) which can be accessible from other machines via UNC (Universal Naming Convention) path names. Interactive and batch jobs can then access files just as they would on the local host.

LSF can also be used on systems without shared file space, using built-in remote file access to move job input and output. Additionally, batch jobs can also be run on systems without shared user accounts by using LSF's account mapping facility.

Almost all LSF administrative tasks can be done from a non-root account, so LSF can be used on groups of hosts where other system administration tasks are not shared.

If you have more than one type of host, you should put all available host types together in a single cluster. If you have applications that require specific host types, you can configure resource requirements to select the correct host type for each job. This gives users transparent access to applications, regardless of the host(s) to which they are logged in.

LSF is known to operate effectively in clusters of several hundred hosts, clusters supporting a heavy workload, and clusters with a wide range of system types and sizes. There is no built-in limitation to cluster scalability. The maximum size of an LSF cluster, while maintaining good performance, is determined by the system and network environment, as well as the load on your network and the memory available on your hosts.

The cluster size you select depends on the number of hosts you have available, the administrative organization of the hosts, and the tasks you wish to run. Larger clusters usually allow better load sharing, at the cost of slightly more processing overhead in the LSF servers.

Hosts which have multiple network interfaces, each with its own network address, may require special consideration. If such multi-homed hosts will be installed in the cluster, see *Appendix E, 'Host Naming', beginning on page 117* to determine if additional configuration is required.

Client Hosts and Server Hosts

All hosts in an LSF cluster can send jobs to other hosts. A *server host* is a host where LSF sends jobs to run. A *client host* is a host that only sends jobs out to other hosts to run. Client hosts do not run any LSF daemons and do not run jobs from other hosts.

You should use as many hosts as possible as servers. The more resources you have available for load sharing, the better performance you can get from your cluster. Client hosts can be used when administrative or resource constraints prevent you from using some hosts as servers, or the hosts are too slow or do not have enough resources to run jobs.

One of the server hosts in each cluster is designated as the LSF master host and acts as the overall coordinator for that cluster.

LSF Directory Structure

Because LSF products have the flexibility to operate in network environments consisting of hosts of a variety of hardware/operating system combinations, you should choose to install them to a location which simplifies setup and administration as much as possible. A single LSF cluster can include hosts of a single type (homogeneous) or hosts of more than one type (heterogeneous).

There are a number of factors involved, including host type(s), file system type(s), and cluster size(s). There are many possible combinations, and a number of variable elements are involved—each site will be different.

The specific installation directory you choose will depend upon the machines on which you want to install and run LSF products, and on the type of shared file systems you are using.

Choosing the Installation Directories

The components of LSF are divided into those files that do not depend on the host type and those that do. The LSF custom installation procedure allows you to choose where to install all parts of the distribution. Using the default installation mode, all parts of

1   LSF Installation Concepts

LSF are installed under a single top-level directory—LSF_TOP. The file server will contain the LSF executables for all host types. LSF_TOP must be a local directory.

Figure 1   LSF Directory Structure
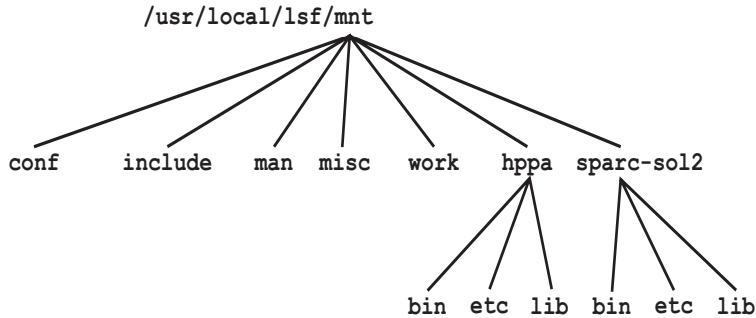
UNIX   For example, LSF_TOP may be `/usr/local/lsf`.

NT   For example, LSF_TOP can be the `LSF` share on a server referenced with the UNC name `\\SERVER\LSF`.

All the host-type specific files are placed in a subdirectory of `LSF_TOP/`mnt. In the diagram, there are directories for the HP-UX and SOLARIS versions of the software.

UNIX   `LSF_TOP/`mnt must be mounted on every LSF host. The default installation procedure creates the mnt subdirectory if it doesn't already exist. Symbolic links are used so that each machine sees the correct host type-specific files. In the example in the diagram, the file server should export `/usr/local/lsf/mnt` and all other hosts should mount this as `/usr/local/lsf/mnt`. In order for every host type to find the LSF executables and configuration files under the same file name, the following symbolic links are added on each HP-UX host:

- from `/usr/local/lsf/bin` to `/usr/local/lsf/mnt/hppa/bin`

- from `/usr/local/lsf/lib` to `/usr/local/lsf/mnt/hppa/lib`

- from `/usr/local/lsf/etc` to `/usr/local/lsf/mnt/hppa/etc`

and similarly for the Solaris hosts, replacing hppa with sparc-sol2. Now users can put `/usr/local/lsf/bin` in their PATH environment variable, and their PATH is valid on all hosts.

| NT | In Windows environments, symbolic links are not supported. You can use login scripts to set the PATH variable differently based on the type of the host. |

The installation examples use `/usr/local/lsf` as the `LSF_TOP` directory. If you install LSF under another directory name, make sure that `LSF_TOP` is local to the host type, and that `LSF_TOP/mnt` is mounted on all LSF hosts.

LSF Variables

Some of the variables you will encounter during the installation procedure are listed below, along with their default values.

LSF_TOP

This variable specifies the top-level directory under which all LSF files are installed. `LSF_TOP` must be local to the host type (i.e. it could be a local directory similar to `/tmp` on each host) or it could be a partition on a file server shared by a set of host types.

In the installation depicted in *Figure 1 on page 4*, LSF_TOP is local to every host in the cluster, and the `mnt` subdirectory is mounted on each host from the file server. Host type-specific directories are created on the file server and exported as part of the LSF_TOP mount.

| UNIX | Default: `/usr/local/lsf` |

| NT | Default: `\\SERVER\LSF` |

LSF_MACHDEP

Specifies the directory where host type dependent files are installed. In clusters with a single host type (homogeneous clusters), `LSF_MACHDEP` is usually the same as

`LSF_INDEP`. The machine dependent files are the user programs, daemons, and libraries.

UNIX   Default: `/usr/local/lsf`

LSF_INDEP

Specifies the default top-level directory for all host type independent LSF files. This includes manual pages, configuration files, working directories, and examples. For example, defining `LSF_INDEP` as `/usr/local/lsf` places manual pages in `/usr/local/lsf/man`, configuration files in `/usr/local/lsf/conf`, and so on.

UNIX   Default: `/usr/local/lsf/mnt`

LSF_BINDIR

Directory where all user commands are installed (default: `LSF_MACHDEP/bin`).

LSF_CONFDIR

The directory where all LIM configuration files are installed. These files are shared throughout the system and should be readable from any host. This directory can contain configuration files for more than one cluster (default: `LSF_INDEP/conf`).

LSF_ENVDIR

This variable specifies the directory in which the `lsf.conf` file can be found.

UNIX   By default, `lsf.conf` is installed by creating a shared copy in `LSF_CONFDIR` and adding a symbolic link from `/etc/lsf.conf` to the shared copy. If `LSF_ENVDIR` is set, the symbolic link is installed in `LSF_ENVDIR/lsf.conf`.

Default: `/etc`

NT   Default: `LSF_TOP\etc`

LSF_LOGDIR

UNIX   This is an optional definition.

If `LSF_LOGDIR` is defined, error messages from all servers are logged into files in this directory. If a server is unable to write in this directory, then the error logs are created in `/tmp`.

If `LSF_LOGDIR` is not defined, then `syslog` is used to log everything to the system log using the `LOG_DAEMON` facility. The syslog facility is available by default on most systems. The `/etc/syslog.conf` file controls the way messages are logged, and the files they are logged to. See the manual pages for the `syslogd` daemon and the `syslog` function for more information (default: log messages go to `syslog`).

NT   This is required.

If a server is unable to write in the LSF_LOGDIR, then the error logs are created in `C:\temp`.

LSF_SERVERDIR

Directory where all server binaries are installed. These include `lim`, `res`, `nios`, `sbatchd`, `mbatchd`, `eeventd` (for LSF JobScheduler only). If you use `elim`, `eauth`, `eexec`, `esub`, etc, they should also be installed in this directory (default: `LSF_MACHDEP/etc`).

LSB_CONFDIR

LSF Batch and LSF JobScheduler configuration directories are installed under `LSB_CONFDIR`. Configuration files for each LSF cluster are stored in a subdirectory of `LSB_CONFDIR`. This subdirectory contains several files that define the LSF Batch user and host lists, operation parameters, and batch queues.

All files and directories under `LSB_CONFDIR` must be readable from all hosts in the cluster. `LSB_CONFDIR/`*cluster*`/configdir` must be owned by the LSF administrator.

You should not try to redefine this parameter once LSF has been installed. If you want to move these directories to another location, use `lsfsetup` utility and choose the

`Product Install` option to install configuration files (default: `LSF_CONFDIR/lsbatch`).

LSB_SHAREDIR

LSF Batch and LSF JobScheduler keep job history and accounting log files for each cluster. These files are necessary for correct operation of the system. Like the organization under `LSB_CONFDIR`, there is one subdirectory for each cluster.

The `LSB_SHAREDIR/cluster/logdir` directory must be owned by the LSF administrator (default: `LSF_INDEP/work`).

LSF Distribution Files

LSF is available on a variety of distribution media. Each LSF distribution medium is shipped with instructions for reading the software on your system. This procedure creates a directory on your disk, which is the *distribution directory*. The directory name starts with lsf and includes the LSF version number and host type. For example, the distribution directory for the Solaris 2.x version of LSF 3.1 is called lsf3.1_sparc-sol2.

If you obtained LSF by download from Platform's WWW or FTP sites, you can go directly to the next section, *'Loading LSF on UNIX'*.

UNIX   ## Loading LSF on UNIX

When LSF is distributed on tape, the tape is in tar format, and the contents are compressed tar archives for each host type supported by LSF. To see the contents of the tape, run the command:

```
% tar tvf /dev/tape_drive_device
```

You may need to use the `tar f` option and specify the name of your tape device.

After you identify the binary versions you want, extract them from the tape
with the command

```
% tar xvf /dev/tape_drive_device filename ...
```

For example:

```
% tar xvf /dev/rst1 lsf3.1_aix4.Z lsf3.1_alpha.tar.Z
```

LSF is distributed as a compressed tar archive for each host type. The LSF
distribution is named by version and host type e.g. `lsf3.1_sparc-`
`sol2.tar.Z`.

To uncompress the distribution, move the compressed tar file to a
temporary directory with at least 100MB of available space and run the
command:

```
% zcat lsf3.1_sparc-sol2.tar.Z | tar xvf -
```

This creates a distribution directory called `lsf3.1_sparc-sol2` under
the working directory.

NT   Loading LSF on Windows NT

LSF for Windows NT and Windows 95 are distributed as self-extracting
executables (.exe). To uncompress the distribution, run the executable by
double-clicking on it from the File Manager or Windows Explorer. A
prompt will allow for selecting the distribution directory in which the LSF
binaries will be uncompressed. The distribution directory should contain
the setup.exe which performs the installation.

Disk Space Requirements

On all supported platforms except Cray, and regardless of which or how many LSF
products are being installed, LSF requires less than 100MB of disk space for a complete
installation.

On Cray platforms, LSF may require as much as 150MB of disk space.

Installation Account and Privileges

UNIX   You must have superuser privileges (root access) to install LSF products.

NT   You must use a domain account, which is in the domain administrator's group.

LSF Administrator's Account

You must choose a user account to act as the primary LSF administrator. This account owns the LSF configuration files and has permission to reconfigure LSF and to control batch jobs submitted by other users. You can use an existing user account, or you can create a new account. By creating a separate LSF administrator account you can allow more than one person to modify the configuration files; if you assign only one individual as the administrator then no one else can modify the configuration.

Once you have installed LSF, you can configure secondary LSF administrators. Secondary LSF administrators have the same privileges as the primary administrator except that they do not have permission to update the LSF configuration files as these files are owned by the primary administrator.

You should not configure the root account as the LSF administrator.

UNIX   Many network installations restrict the root account so that it does not have permission to write to NFS or AFS mounted directories.

Platform-Specific Notes

If you are installing LSF on a Network File System (NFS) mounted directory then the NFS server must allow the root account on the client to write to the mounted file system (it must be exported with setuid enabled).

NT	The primary administrator is also used as the account to run the LSF daemons. It is assigned certain privileges necessary to run jobs during the installation.

Licensing Information

You must have a software license key to run LSF. You can get a license key from your LSF vendor, or from Platform Computing. There are two types of LSF license keys: temporary and permanent.

A temporary (DEMO) license key will allow you to use LSF for a limited time only, and may easily be replaced with a permanent license key later on.

A permanent license key cannot be created for you until you supply information identifying the host(s) on which the LSF license server will run at your site. The LSF installation utility can help you retrieve this information and install your permanent license key. Instructions for obtaining a permanent license key are contained in *'Getting License Key Information' on page 34*.

Getting a License Key

If you received a DEMO license key, you can proceed directly with the installation. To get a permanent license from your LSF vendor, see the Release Notes or *'Getting License Key Information' on page 34*. You can install LSF with a DEMO license key and change to a permanent license later with no interruption in service.

Store the license key in a file. `lsfsetup` automatically finds your license key if you store the license key in a file named `license.dat` in the distribution directory. Otherwise, you must enter the path name of the file during the installation.

Backing Up the System Disk

You should back up the root partition disk on each host and the file server disks where LSF products will be placed before installing LSF. Use the normal backup procedure for your site.

2. Default Installation

Introduction

This section of the *LSF Installation Guide* covers the default procedure for initial installations of LSF products on UNIX platforms (for Windows NT, see *'LSF on Windows NT' on page 47*). This is the quickest and easiest way to install LSF products, because a number of installation settings are assigned default values which you must accept. If you cannot accept all of these default values, you must use LSF's custom installation procedure, which allows you to assign alternate values.

What the Default Installation Assumes

When you use LSF's default installation procedure, the parameters you must accept are:

*   all binaries and configuration files will be installed on a single file server, under a single directory which will be shared by all hosts in the cluster—this directory must be accessible with the same path name on all machines

*   all paths in the `lsf.conf` file are machine independent, and `lsf.conf` is placed in LSF_CONFDIR rather than LSF_SERVERDIR

*   LSF daemons are configured to log to `/tmp` rather than the system log

*   service ports are defined automatically in `lsf.conf` instead of in `/etc/services` or using NIS

*   The DEMO license file is automatically installed into LSF_CONFDIR (installation directory for a permanent license file is still up to you)

2   Default Installation

What You Will Do In This Section

This chapter describes the procedure for loading LSF distribution files and installing the LSF software, which are:

- installing LSF software for one host type on the file server host, using LSF's installation program, `lsfsetup`

- installing the LSF software license key (optional for now, but must be done before you can use LSF products)

- optionally, installing LSF software for additional host types. This is necessary if you plan to create an LSF cluster which includes host machines which do not all use the same operating system.

- mounting directories and creating symbolic links

Default Installation Procedures

After you have successfully installed the LSF files for the initial host type, you can follow the instructions in *'Installing LSF Software for Additional Host Types' on page 17* to install the files for LSF on one or more additional platforms. If all hosts in your LSF cluster are running under the same operating system, you should skip to *'LSF Host Setup' on page 19*.

If you do not install your license key during this procedure, you will have to do it later using the procedure found in *'License Installation' on page 33*.

All LSF files, both host type dependent and host type independent, will physically reside on the file server host at your site. For this installation procedure, the LSF directories are assumed to be NFS-mounted on the other LSF machines in the cluster, and accessible under the same directory name.

If you are installing on an AFS file system, follow the instructions in *'Installation on AFS' on page 97*. If you are installing on DCE/DFS, follow the instructions in *'Installation on DCE/DFS' on page 105*.

2

Installing LSF Software for the Initial Host Type

This procedure describes installing the LSF files on a file server, for the host type you have chosen to install first. These installation procedures will work correctly even if the file server is not the same host type as the LSF software you are installing. Installation takes from 10 to 20 minutes for the first host in an LSF cluster, and approximately 3 minutes for each additional host in the cluster.

Step 1 Load the distribution file for the version of LSF you are installing first (from the distribution medium or downloaded from Platform's WWW or FTP sites), and uncompress it.

This will create the distribution directory. See *'LSF Distribution Files' on page 8* for details if you have yet to take this step.

Step 2 Log in to the file server host as root.

Step 3 Change directory to the distribution directory.

Step 4 Run the `./lsfsetup` program.

LSF's install program starts up, and its main menu is displayed.

The `lsfsetup` program prompts you for all information needed to install LSF. Most prompts include a default value, displayed in square brackets. If you press RETURN, the default value is used.

Step 5 Choose option 1, 'Default Install'.

All installable LSF products are displayed in a numbered list.

Step 6 Specify one or more of the products to install.

If you select more than one product, make sure you separate them with commas.

Step 7 Specify the directory into which you want the LSF files installed. This is the LSF_TOP directory (default `/usr/local/lsf`).

2 Default Installation

Remember that the installation directory you choose must be accessible from all machines in the cluster using the same path name.

Step 8 Specify whether or not to use external user authentication (*eauth*). By default, LSF installs and configures eauth. You may also choose to write and configure your own site-specific eauth after the installation is complete. External authentication is the only type of security that works on Windows NT, so if your cluster is going to include Windows NT machines, you should use eauth.

If you choose not to use eauth, LSF uses privileged ports for authentication, and installs some utilities with the *setuid* bit set, and *root* as the owner of the file.

Step 9 Choose and enter a name for the LSF cluster, and the login name of the LSF administrator's account.

Step 10 Indicate whether or not you want to install your LSF license key.

If you do not want to install your license key now for any reason, or you have not yet obtained it from your LSF vendor, you can install it later by running the lsfsetup program and choosing option 4, License Management.

Detailed instructions and information on installing a license key this way are contained in *'License Installation' on page 33*.

Step 11 If you want to install your license key now, indicate where you have placed it.

The lsfsetup program determines whether the license is a DEMO or a permanent license.

If it is a DEMO license, it is copied into the LSF_CONFDIR. If it is a permanent license, a menu of choices is displayed, from which you can select the appropriate action. For more information, see *'License Installation' on page 33*.

You are informed when the installation for this initial host type is finished.

Note

> *When you run* `lsfsetup`*, you will be prompted for additional information if you are installing LSF Analyzer or LSF Parallel.*
>
> *- If you are installing LSF Analyzer, specify the machine that you want to use as the LSF database server. It should have at least 200MB free disk space.*
>
> *- If you are installing LSF Analyzer, specify the LSF database directory on the LSF database server. The default is* `/usr/local/lsf_db`*.*
>
> *- If you are installing LSF Parallel, LSF creates two files in the* `LSF_BINDIR` *directory,* `mpicc` *and* `mpif77`*. These are wrapper scripts that compile an LSF Parallel MPI program in the cluster. Specify the C and Fortran compilers that you want these scripts to use. The defaults are* `cc` *and* `f77`*.*

If you are not installing LSF on additional host types, you can skip to for instructions on how to complete your LSF installation and setup.

If you are installing LSF on one or more additional host types, follow the instructions in .

Installing LSF Software for Additional Host Types

If you plan to use LSF products in a heterogeneous environment, you must install the LSF files which are specific to each operating system in the cluster. The process is similar to that used for the installation of LSF for the initial host type, but must now be repeated for each operating system.

These steps install the LSF host type dependent files for the type of host corresponding to the distribution file you are using to install them.

Step 1   Obtain the appropriate version of the LSF software from the distribution medium or download it from Platform's WWW or FTP sites. On the file server, uncompress the distribution file and extract the installation files.

   A distribution directory is created. If you are unsure about any part of this procedure, see for details.

Step 2   Log in to the file server host as `root`.

2 Default Installation

Step 3 Change directory to the distribution directory.

Step 4 Run the `./lsfsetup` program.

LSF's install utility starts up, and its main menu is displayed.

Step 5 Choose option 1, 'Default Install'.

Step 6 Specify the directory into which the first LSF host type was installed.

The setup utility will detect that the initial host type has been installed, and proceed to install the host type specific files for the host type you are installing now.

The setup utility will also look for an existing license key, the `license.dat` file.

Step 7 If the `lsfsetup` program detects an existing license key, simply allow the installation to proceed. If you did not install a license key when you installed the initial (or any subsequent) additional host type, you will be prompted to install it now.

If you do not want to install your license key now for any reason, or you have not yet obtained it from your LSF vendor, you can install it later by running the `lsfsetup` program and choosing option 4, License Management.

Detailed instructions and information on installing a license key this way are contained in *'License Installation' on page 33*.

Step 8 If you want to install your license key now, indicate where you have placed it.

The `lsfsetup` program determines whether the license is a DEMO or a permanent license.

If it is a DEMO license, it is copied into the LSF_CONFDIR. If it is a permanent license, a menu of choices is displayed, from which you can select the appropriate action. For more information, see *'License Installation' on page 33*.

Step 9 Allow the installation to proceed.

You are informed when the installation for this host type is finished.

If you are not installing LSF on additional host types, you can continue with *'LSF Host Setup' on page 19* for instructions on how to complete your LSF installation and setup.

If you need to install LSF for one or more additional host types, repeat the steps in this section for each one, until you have installed LSF software for all the host types you plan to include in your cluster. When you have finished, you can continue with the following section, *'LSF Host Setup'*.

LSF Host Setup

At this point, you have finished the physical installation of LSF files on the file server host. Before you can start the LSF daemons and test the cluster configuration, you must perform a few simple procedures on each host machine you want to include in your LSF cluster.

- `LSF_TOP/mnt` must be mounted on each LSF host from the file server host

- the 'Host Setup' procedure in the `lsfsetup` program must be run on each host in the cluster

Mounting the LSF_TOP/mnt Directory

When you use LSF's default installation procedure, it is assumed that all hosts in the cluster will share LSF files from a single file server, accessible with the same path name. All LSF files are installed on the file server under the `LSF_TOP` directory (which you specified when you installed the LSF software).

Step 1 If you aren't already, log in to the LSF host as `root`.

Step 2 Create the `LSF_TOP` directory (by default, it is `/usr/local/lsf`).

Step 3 Mount the `LSF_TOP/mnt` directory from the file server as `LSF_TOP/mnt` (assuming the default value, this is `/usr/local/lsf/mnt`).

You must not mount this directory with the `nosuid` flag; some LSF programs require setuid permission. See the manual page for the `mount` command for more details (the specifics vary from platform to platform).

Step 4   Create the symbolic links appropriate for the host type. For example, on an HP-UX host, you might do the following:

```
ln -s /usr/local/lsf/mnt/hppa/bin /usr/local/lsf/bin
ln -s /usr/local/lsf/mnt/hppa/lib /usr/local/lsf/lib
ln -s /usr/local/lsf/mnt/hppa/etc /usr/local/lsf/etc
```

Step 5   Repeat these steps for each LSF host in the cluster.

If you are unclear as to LSF's directory structure, see *'LSF Directory Structure' on page 3* for detailed information.

Executing the Host Setup Procedure

After mounting `LSF_TOP/mnt`, you must run the `lsfsetup` program and execute its 'Host Setup' procedures on each LSF host. These procedures will:

- create symbolic links to host type specific directories, allowing all hosts to access the host type specific LSF binaries using the same path

- modify startup files on the LSF server hosts so that the LSF daemons start automatically when the machines boots up

- modify the `lsf.cluster.`*`cluster`* file to include all the new hosts

Step 1   If you aren't already, log in to the LSF host as `root`.

Step 2   Run the `lsfsetup` program.

It has been installed in the `mnt/<host_type>/etc` subdirectory of `LSF_TOP`, the directory you specified for the LSF installation.

Step 3   Select option 3, 'Host Setup'.

Step 4   You are prompted to confirm the location of the LSF configuration file (`lsf.conf`) you want to use to set up the cluster.

The following symbolic links are created:

- from `LSF_TOP/bin` to `LSF_TOP/mnt/<host_type_directory>/bin`

- from `LSF_TOP/etc` to `LSF_TOP/mnt/<host_type_directory>/etc`

- from `LSF_TOP/lib` to `LSF_TOP/mnt/<host_type_directory>/lib`

Step 5   You are asked to specify if this host will be a LSF server host or a LSF client host. By default, each host is a server host. If you are installing a server host, proceed to the next step in this procedure.

If you choose to make the host a client host, you will be prompted to specify a server host (running LIM) that will accept jobs from the client host and submit them to the cluster. You only need to specify one server host, but you may choose to specify additional ones for backup purposes. The client host will attempt to contact the server hosts in the order that they are listed.

Step 6   If you are installing a server host, the `lsfsetup` program attempts to modify the `rc` file so that the LSF daemons start automatically when the host is booted or rebooted.

The host setup procedure is complete.

You should repeat this procedure for each host in the cluster. When you have finished setting up all the hosts in your cluster, you can move on to the following section, *'Next Steps'*, for further instructions.

Next Steps

If you have finished installing LSF software for all desired host types, setting up individual LSF hosts, and acquiring and installing a license key, you are ready to start the LSF daemons (except on LSF client hosts) and test the installation. Instructions for this are given in *'After Installation' on page 63*.

3. Custom Installation

Introduction

This chapter describes the procedure for installing the LSF system software using the LSF installation and setup program, `lsfsetup`. When you install LSF following the steps in this section, you have complete control over all aspects of the installation, and will be asked where to place configuration files, set up service ports, and other questions about the LSF installation.

If you could not accept one or more of the preconfigured settings in the default LSF setup described in the previous chapter, or if you are experienced with and generally knowledgeable about LSF and operating system software, then you should be able to use LSF's custom installation procedure.

What You Will Do In This Section

This chapter describes the procedures for installing the LSF software, which are:

- installing LSF software for one host type on the file server host, using LSF's installation program, `lsfsetup`

- reviewing, modifying, and accepting the LSF configuration settings

- installing the LSF software license key (optional for now, but must be done before you can use LSF products), or obtaining the information necessary to get an LSF software license key

- setting up LSF host models and types, and modifying the LSF configuration file as necessary

- optionally, installing LSF software for additional host types. This is necessary if you plan to create an LSF cluster which includes host machines which do not all use the same operating system.

- mounting directories, creating symbolic links, and setting up LSF service port numbers

Custom Installation Procedures

After you have successfully installed the LSF files for the initial host type, you can follow the instructions in *'Installing LSF Software for Additional Host Types' on page 28* to install the files for LSF on one or more additional platforms—but only if you plan to create an LSF cluster including host machines which do not all use the same operating system. If all hosts in your LSF cluster are running under the same operating system, you should skip to *'LSF Host Setup' on page 29*.

If you do not install your license key during this procedure, you will have to do it later using the procedure found in *'License Installation' on page 33*.

All LSF files, both host type dependent and host type independent, will physically reside on the file server host at your site.

After the software is installed, some setup must be done for each host in the LSF cluster. These steps are given in *'LSF Host Setup' on page 29*.

If you are installing on an AFS file system, follow the instructions in *'Installation on AFS' on page 97*. If you are installing on DCE/DFS, follow the instructions in *'Installation on DCE/DFS' on page 105*.

Installing LSF Software for the Initial Host Type

This procedure allows you to install all LSF files—host type independent and host type dependent—for the host type you have chosen to install first, on the file server host you have selected. The LSF distribution file you obtained, and from which you extracted and uncompressed the LSF installation files, determines which host type dependent files are installed.

3

These installation procedures will work correctly even if the file server host is not the same host type as the LSF software you are installing. Installation takes from 10 to 20 minutes for the first host in an LSF cluster, and approximately 3 minutes for each additional host in the cluster.

Step 1 Log in to the file server host as root.

Step 2 Load the distribution file for the version of LSF you are installing first (from the distribution medium or download it from Platform's WWW or FTP sites), and uncompress it.

This will create the distribution directory. See *'LSF Distribution Files' on page 8* for details if you have yet to take this step.

Step 3 Change directory to the distribution directory.

Step 4 Run the `./lsfsetup` program.

The `lsfsetup` program prompts you for all information needed to install LSF. Most prompts include a default value, displayed in square brackets. If you press RETURN, the default value is used.

Step 5 Choose option 2, 'Custom Install'.

All LSF installable products are displayed in a numbered list.

Step 6 Specify one or more of the products to install.

If you select more than one product, make sure you separate them with commas.

Step 7 Specify whether or not to use external user authentication (*eauth*). By default, LSF installs and configures eauth. You may also choose to write and configure your own site-specific eauth after the installation is complete. External authentication is the only type of security that works on Windows NT, so if your cluster is going to include Windows NT machines, you should use eauth.

If you choose not to use eauth, LSF uses privileged ports for authentication, and installs some utilities with the *setuid* bit set, and *root* as the owner of the file.

3 Custom Installation

Step 8 Specify LSF_MACHDEP, the directory into which you want the LSF host type dependent files installed.

This is the directory that contains all host type dependent LSF files, which include programs, daemons, and libraries compiled for a specific type of host machine. These files can be shared by all hosts of the same type in the cluster.

More information on the LSF_MACHDEP directory can be found in *'LSF Directory Structure' on page 3*.

Step 9 Specify LSF_INDEP, the directory into which you want the LSF host type independent files installed.

This is the directory that contains all host type independent LSF files, which include manual pages, configuration files, and working directories. These files can be shared by all hosts in the cluster.

More information on the LSF_INDEP directory can be found in *'LSF Directory Structure' on page 3*.

Step 10 Enter a name for the LSF cluster.

The name may be up to 39 characters in length, and should not be the same as the name of any host in the cluster.

Step 11 Enter the login name of the LSF administrator.

The installed LSF files will be owned by this account.

A menu containing options for the LSF configuration settings is displayed.

Step 12 Review and modify the LSF configuration settings as needed.

Choose option 1, 'List Current Settings', to review the LSF configuration settings.

Choose option 2, 'Change Current Settings', to change any or all of the LSF configuration settings.

Choose option 3, 'Install the Software Now', to begin installing LSF files onto the server.

Choose option 4, 'Use Default Settings', to reset all LSF configuration settings to their default values, which are based on the values you entered for LSF_INDEP, LSF_MACHDEP, and the cluster name and administrator's account name.

Step 13 Choose option 3, 'Install the Software Now', when you are satisfied that all of the LSF configuration variables are set the way you want them to be.

This copies all the LSF files into their final locations and creates a default set of configuration files. The lsfsetup program is installed into the LSF_SERVERDIR directory. You can use lsfsetup later to maintain LSF.

This part of the installation procedure may take a few minutes, but you will be notified when it has been successfully completed.

Step 14 Press the **RETURN** key when prompted.

A menu offering you license key options is displayed.

Step 15 Select the option you want.

If you do not want to install your license key now for any reason, or are planning to use a DEMO license and have not yet obtained it, select the [q]uit option. Instructions for obtaining a DEMO license are in *'Licensing Information' on page 11*. You can install it after you have finished installing LSF by following the instructions in *'License Installation' on page 33*.

If you require a permanent license and do not yet have it, select option 1, 'Get Information for a Permanent License'.

Detailed instructions and information on installing a license key this way are contained in *'License Installation' on page 33*.

Step 16 If you want to install your license key now, indicate where you have placed it.

The lsfsetup program determines whether the license is a DEMO or a permanent license.

3 Custom Installation

If it is a DEMO license, it is copied into the LSF_CONFDIR. If it is a permanent license, a menu of choices is displayed, from which you can select the appropriate action. For more information, see *'License Installation' on page 33*.

Note

> *When you run* lsfsetup, *you will be prompted for additional information if you are installing LSF Analyzer or LSF Parallel.*
>
> *- If you are installing LSF Analyzer, specify the machine that you want to use as the LSF database server. It should have at least 200MB free disk space.*
>
> *- If you are installing LSF Analyzer, specify the LSF database directory on the LSF database server. The default is* /usr/local/lsf_db.
>
> *- If you are installing LSF Parallel, LSF creates two files in the* LSF_BINDIR *directory,* mpicc *and* mpif77. *These are wrapper scripts that compile an LSF Parallel MPI program in the cluster. Specify the C and Fortran compilers that you want these scripts to use. The defaults are* cc *and* f77.

If you are not installing LSF on additional host types, continue with the procedure in *'LSF Host Setup' on page 29*. If you are installing LSF on one or more additional host types, see the following section, *'Installing LSF Software for Additional Host Types'*.

Installing LSF Software for Additional Host Types

If you plan to use LSF products in a heterogeneous environment, you must install the LSF files which are specific to each operating system in the cluster. The process is similar to that used for the installation of LSF for the initial host type, but must now be repeated for each operating system.

Step 1 Obtain the appropriate version of the LSF software from the distribution medium or download it from Platform's WWW or FTP sites. Uncompress the distribution file and extract the installation files.

A distribution directory is created. See *'LSF Distribution Files' on page 8* for details.

Step 2 Log in to the file server host as root.

Step 3 Change directory to the distribution directory.

Step 4   Run the `./lsfsetup` program.

LSF's install utility starts up, and its main menu is displayed.

Step 5   Choose option 2, 'Custom Install'.

Step 6   Choose option 2, 'Install Another Host Type'.

Step 7   Confirm the location of the LSF configuration file (`lsf.conf`)—created when you installed the initial host type.

Step 8   Specify the LSF_MACHDEP directory (specified when you installed the previous host type(s), default value `/usr/local/lsf`).

The other installation settings are automatically updated.

Step 9   Choose option 3, 'Install the Software Now'.

The `lsfsetup` program installs all the products necessary for the additional host type.

You are informed when the installation for this host type is finished.

If you are not installing LSF on additional host types, you can continue with *'LSF Host Setup' on page 29* for instructions on how to complete your LSF installation and setup. If you need to install LSF for an additional host type, repeat the steps in this section once for each additional host type.

LSF Host Setup

At this point, you have finished the physical installation of LSF files on the machine you have chosen to be your file server host. Before you can start the LSF daemons and test the cluster configuration, you must perform a few simple procedures on each host machine you want to include in your LSF cluster.

• LSF_TOP/mnt must be mounted on each LSF host from the file server host

- the 'Host Setup' procedure in the `lsfsetup` program must be run on each host in the cluster

Mounting the LSF_TOP/mnt Directory

When you use LSF's custom installation procedure, you have full control over where you install the LSF files and how the LSF hosts in the cluster access them. To make the installation procedure as easy as possible, you should install all LSF files under the LSF_TOP directory (which you specified when you installed the LSF software), and it is this directory which you should mount on each LSF host.

Step 1   If you aren't already, log in to the LSF host as `root`.

Step 2   Create the LSF_TOP directory (the default value is `/usr/local/lsf`).

Step 3   Mount the LSF_TOP/mnt directory from the file server as LSF_TOP/mnt (assuming the default value, this is `/usr/local/lsf/mnt`).

        You must not mount this directory with the `nosuid` flag; some LSF programs require setuid permission. See the manual page for the `mount` command for more details (the specifics vary from platform to platform).

Step 4   Create the symbolic links appropriate for the host type. For example, on an HP-UX host, you might do the following:

```
ln -s /usr/local/lsf/mnt/hppa/bin /usr/local/lsf/bin
ln -s /usr/local/lsf/mnt/hppa/lib /usr/local/lsf/lib
ln -s /usr/local/lsf/mnt/hppa/etc /usr/local/lsf/etc
```

Step 5   Repeat these steps for each LSF host in the cluster.

If you are unclear as to LSF's directory structure, see *'LSF Directory Structure' on page 3* for detailed information.

Executing the Host Setup Procedure

After mounting LSF_TOP/mnt, you must run the `lsfsetup` program and execute its 'Host Setup' procedures on each LSF host machine. These procedures will:

- create a symbolic link to the LSF configuration file `lsf.conf`, simplifying setup and maintenance by allowing all hosts to access the same configuration file

- modify startup files on the LSF server hosts so that the LSF daemons start automatically when the machines boots up

- modify the `lsf.cluster.`*cluster* file to include all the new hosts

- check to see where the LSF service ports have been registered, and if they have been registered correctly

Step 1 If you aren't already, log in to the LSF host as `root`.

Step 2 Run the `lsfsetup` program.

It has been installed in the LSF_MACHDEP/etc directory.

Step 3 Select option 3, 'Host Setup'.

Step 4 You are prompted to confirm the location of the LSF configuration file (`lsf.conf`) you want to use to set up the cluster.

Step 5 You are asked to specify if this host will be a LSF server host or a LSF client host. By default, each host is a server host. If you are installing a server host, proceed to the next step in this procedure.

If you choose to make the host a client host, you will be prompted to specify a server host (running LIM) that will accept jobs from the client host and submit them to the cluster. You only need to specify one server host, but you may choose to specify additional ones for backup purposes. The client host will attempt to contact the server hosts in the order that they are listed.

Step 6 If you are installing a server host, the `lsfsetup` program attempts to modify the `rc` file so that the LSF daemons start automatically when the host is booted or rebooted.

The host setup procedure is complete.

You should repeat this procedure for each host in the cluster. When you have finished setting up all the hosts in your cluster, you can move on to the following section, *'Next Steps'*, for further instructions.

Next Steps

If you have finished installing LSF software for all desired host types, setting up individual LSF hosts, modifying the LSF configuration file, and acquiring and installing a license key, you are ready to start the LSF daemons (except on LSF client hosts) and test the installation.

Instructions and information are given in *'After Installation' on page 63*.

4. License Installation

This chapter describes the procedure for installing and/or configuring the license file for LSF on UNIX platforms. If you are preparing to execute the procedures in this section, you should have already installed the LSF software.

Getting a License Key

If you received a DEMO license key, you can proceed directly with the installation. To get a permanent license from your LSF vendor, see the Release Notes or *'Getting License Key Information' on page 34.* You can install LSF with a DEMO license key and change to a permanent license later with no interruption in service.

Store the license key in a file. `lsfsetup` automatically finds your license key if you store the license key in a file named `license.dat` in the distribution directory. Otherwise, you must enter the path name of the file during the installation.

Licensing the Different LSF Products

LSF Suite 3.2 includes the following products: LSF Base, LSF Batch, LSF JobScheduler, LSF MultiCluster, LSF Make, LSF Analyzer, and LSF Parallel. LSF Base is a prerequisite for all other LSF products.

Because all products are packaged in the same distribution file, LSF's installation program (`lsfsetup`) requires you to specify which products you want to install. By default, LSF Batch and LSF Base are installed.

4   License Installation

Changes to enable a particular product in a cluster are handled automatically by `lsfsetup` based on your input during the installation process. You can always subsequently modify the environment to reflect a new product license.

Note

> *An LSF client host is independent of the products that run on the LSF server hosts. That is, there is no difference, for example, between a client for LSF Batch and a client for LSF JobScheduler.*

Each of these products is licensed independently. Individual hosts can be configured to run as LSF Batch servers or LSF JobScheduler servers within the same cluster. LSF MultiCluster is licensed on a cluster-wide basis, that is, the entire cluster is either enabled or disabled for multicluster operation. LSF JobScheduler has an additional scheduler license for the master server, which does the scheduling, in addition to serving licenses for the job execution servers.

The license file used to serve the cluster must have the corresponding products. A host will show as unlicensed if the license for the product it was configured to run is unavailable. For example, if a cluster is configured to run LSF JobScheduler on all hosts, and the license file does not contain the LSF JobScheduler product, then the hosts will be unlicensed, even if there are licenses for LSF Base or LSF Batch.

Getting License Key Information

This section explains in detail how to get the information necessary to acquire a permanent license key for LSF. You do not need to read this section if you:

- already have a permanent license key

- had no difficulty getting the information needed for a permanent license key using the `lsfsetup` command

- are installing a DEMO license key at this time (because this type of license does not require you to run a license server)

LSF uses the FLEXlm license management software from Globetrotter Software. FLEXlm supports file-based *DEMO licenses* and server-based *permanent licenses*.

You must have a license key to run LSF. If you are installing LSF for a limited time evaluation, you should have received a DEMO key from your software vendor. If you are installing LSF for permanent use, you must get a permanent license key from your vendor. You can use a DEMO key to install LSF and get it running, and switch to the permanent license later.

Permanent licenses use a *license server* daemon running on one or more hosts in your network. The license server counts the number of licenses in use. For more information on how FLEXlm works and for examples of license keys, see *'LSF License Management' on page 109.*

The FLEXlm license key and license server are independent of LSF clusters and LSF server hosts. You can organize your hosts into clusters any way you choose. The license server counts only the total number of hosts running LSF; these hosts can belong to any cluster in your network. As long as all your hosts can contact each other on the network, you should request a single license key that covers all the hosts on which you plan to run LSF.

If you are already running FLEXlm to support other software licenses, you can add your LSF license key to the existing FLEXlm license file. If you are not already using FLEXlm, you must choose a host or hosts to run the license server daemon.

FLEXlm normally runs the license server daemon on one host. LSF tolerates failure of the license server daemon for up to 60 hours, as long as the LSF Load Information Manager (LIM) on the master host is not restarted or shutdown. In spite of this, if you are concerned about reliability, you can run the license server daemon on three hosts. Software licenses are available as long as two of the three license servers are available.

You should run the license server on the host that is the NFS server for the LSF software. That way the licenses are available whenever the software is. However, it is not recommended that you make the license server host the same as the master host for the cluster. If you do this, and the master host goes down, the backup master that takes over will not be able to check license tokens out from the license server on the original master, which has failed.

To create a permanent license key, your software vendor needs a hardware host name and host identifier for each license server host. LSF comes with a script to help collect this information.

Step 1   Change directory to the distribution directory.

Step 2   Run the `./lsfsetup` command.

Step 3   Choose option 4, 'License Management'.

Step 4   From the next menu, choose option 1, 'Get Information For a Permanent License'.

If you already have FLEXlm installed, `lsfsetup` asks whether you want to use the same license server hosts.

If you answer yes, `lsfsetup` uses the server host IDs from your existing FLEXlm license file. Otherwise, `lsfsetup` asks for a host name and tries to get the host ID for that host.

If `lsfsetup` is unable to get the host ID, it prompts you to run the `lmhostid` command on each license server host and enter the host IDs for those hosts.

`lsfsetup` creates a file named `license.info`. Follow the instructions provided in your software Release Notes to send the contents of the `license.info` file to your LSF vendor.

If you receive your license key by electronic mail or download from Platform's WWW or FTP sites, copy the file you receive into the distribution directory and name the file `license.dat`. If you receive your license key by paper mail or FAX, use a text editor to create a `license.dat` file containing your key.

Setting Up the License Key

If you have already set up your license key, you do not need to read this section, as it contains detailed descriptions of the procedures for setting up LSF software license keys.

Before performing this step you must get a license key. If you do not have a license key, see *'Getting License Key Information' on page 34*. If you plan to install a permanent license and are waiting for your permanent license key, you can install a DEMO license and switch to the permanent license later on.

Both the license server daemons and the LIM on every host must have access to the license key. For a temporary DEMO license key, you can ensure this by:

- sharing the same license file between all the hosts using NFS

- installing a separate copy of the license file on each host

For a permanent license key, you can use either of these methods, or you can save the license file on the host where the license server is running, and set the LSF_LICENSE_FILE variable in the `lsf.conf` files on all other hosts to `port@host`.

If you are installing a DEMO license, follow the procedure in *'Installing a DEMO License' on page 37*.

If you are installing a permanent license or switching from a DEMO license to a permanent license, and you are not running FLEXlm license server daemons for any other software licenses, follow the procedure in *'Installing a New Permanent License' on page 38*.

If you are installing a new LSF permanent license and you already have license servers running for other software licenses, or if you are upgrading your LSF license, follow the procedure in *'Adding a Permanent License' on page 40*.

Installing a DEMO License

If you are installing LSF with a DEMO license, you do not need to run the license server daemons. Each LSF host reads the license file directly, and LSF runs, without trying to contact the server, until the license expires.

For the DEMO license, you should install the license key in a file named `license.dat` in the LSF configuration directory `LSF_CONFDIR`, as defined in the `lsf.conf` file. Because the configuration directory is normally shared by all hosts in the LSF cluster, you do not need to copy the `license.dat` file to every host.

Step 1 In the distribution directory, run the `./lsfsetup` command.

Step 2 Choose option 4, 'License Management'. Next choose option 2, 'Install a New License From the LSF Vendor'.

Step 3 From the next menu choose option 1, 'Set up DEMO license'.

The command looks for your vendor-supplied license key in the `license.dat` file in the current directory and the parent directory. If the `license.dat` file is not found, `lsfsetup` asks you to enter the full path name of the `license.dat` file containing your DEMO license key.

Step 4   For the location of the installed license file, choose option 2, 'Use $LSF_CONFDIR/license.dat'.

         The license manager checks your `license.dat` file to confirm the licensed products. It then prompts you for permission to enter appropriate products in the 'PRODUCTS=...' line in the `lsf.cluster.`*cluster* file.

Step 5   You have a chance to change your mind before permanently installing the license file. Enter 'y' to commit the changes. At the next prompt, choose option q, 'Quit'. You are now done setting up the LSF DEMO software license.

The `lsfsetup` script installs your key in an existing license file, or creates the file if necessary. The `lsfsetup` program updates the `LSF_LICENSE_FILE` variable in the `lsf.conf` file so that it is equal to the full path name of the license file.

Note

         If you change the location of the installed license key file, you must make sure that the LSF_LICENSE_FILE variable in the `lsf.conf` *file is updated for all hosts in the cluster.*

Installing a New Permanent License

Follow this procedure if you are installing an LSF permanent license in a network with no FLEXlm servers, switching from a DEMO license to a permanent license, or setting up a separate FLEXlm server for the LSF license. If you are adding an LSF license to a FLEXlm license key file that contains other licenses or upgrading an existing LSF permanent license, follow the procedure in *'Adding a Permanent License' on page 40.*

The permanent license must be installed on the license server host. If you are using multiple FLEXlm servers, follow this procedure on any one of the license server hosts to set up the license key file, and then start the license server daemons by hand on the other license server hosts.

4

Step 1 Log in to the license server host as root and change directory to the LSF distribution directory. Copy the license file from your vendor into the distribution directory and name the file `license.dat`.

Step 2 Run the `./lsfsetup` command. Choose option 4, 'License Management'. Next choose option 2, 'Install a New License'. From the next menu choose option 2, 'Set up permanent (floating) license'. The command looks for the LSF `license.dat` file provided by your vendor. If the `license.dat` file is not found in the current directory or the parent directory, the command prompts you to enter the file name.

Step 3 Next `lsfsetup` asks whether you are installing a permanent license key for the first time. This procedure is for setting up a new license, so select option 1, 'First installation of a permanent license'.

Step 4 To use the default location for the FLEXlm license key file, select option 1, 'use /usr/local/flexlm/licenses/license.dat'. If you want to store your `license.dat` file in the LSF configuration directory, choose option 2. Otherwise, choose option 3, and enter the full path name where you want the license file to be installed.

Step 5 If a license file already exists, you can merge the license files or replace the existing file. If your installed license file contains only LSF licenses, choose option 2, 'replace license file'. Otherwise, choose option 1, 'merge license files'.

A copy of the old license file is left in the `license.dat.old` file in the same directory as your installed `license.dat` file.

Step 6 The FLEXlm license server daemons log status and error messages into a file. If you set the `LSF_LOGDIR` parameter in the installation procedure, the license setup puts the FLEXlm log in the file `LSF_LOGDIR/license.log`. Otherwise, you must enter the full path name of a log file to store the FLEXlm log messages. Put the FLEXlm log in the same directory as your other system logs, or in the `/tmp` directory.

Step 7 The `lsfsetup` script asks if you want to start the license server daemons now. Enter 'y'. The daemons are automatically started on the host where `lsfsetup` is running. If you are using three license server hosts, start the license server daemons by hand on the other two hosts.

4   License Installation

To start the daemons by hand, log in as root, change directory to the distribution directory, and run the startup script `lsf_license`:

```
# ./lsf_license start
```

Adding a Permanent License

Follow this procedure if you are adding LSF licenses to an existing FLEXlm license key file. This procedure applies if you have already configured FLEXlm to manage licenses for a different product, or if you have already installed FLEXlm to manage an LSF permanent license and you have received a new license key, for example to support a larger number of hosts.

If you are switching from a DEMO license to a permanent license, follow the instructions in *'Installing a New Permanent License' on page 38*.

Step 1   Log in to the license server host as root and change directory to the distribution directory. Copy the new license information into the file `license.dat`.

Step 2   Run the command `LSF_SERVERDIR/lsfsetup`. Select option 4, 'License Management', and then option 2, 'Install a New License'. If your new license information is not in the file `./license.dat` or `../license.dat`, enter the full path name when prompted.

Step 3   Choose option 2, 'Set up permanent license'. At the next prompt, choose option 2, 'Upgrade an existing permanent license'.

Step 4   Specify the location of your installed FLEXlm license key file. If your license key file is installed in `/usr/local/flexlm/licenses/license.dat`, choose option 1. If your license key file is `LSF_CONFDIR/license.dat`, choose option 2. Otherwise, choose option 3 and enter the full path name of the license file. `lsfsetup` adds your new license keys to the existing license file.

Step 5   Commit the changes to the license file. `lsfsetup` tells the license server daemons to reread the license file, and checks to make sure your LSF license is available.

4

Updating an LSF License

If you purchase additional licenses to use LSF products on more hosts in your LSF cluster, you may be provided with an INCREMENT license key instead of a new FEATURE line.

To install an LSF INCREMENT license key:

Step 1 Edit your `license.dat` file using a text editor like vi or emacs.

Step 2 Add the INCREMENT line immediately after the FEATURE line in the `license.dat` file.

Step 3 Save the file.

Step 4 Run the following program:

```
lmreread -c <LSF_LICENSE_FILE>
```

The `lmreread` program is found in your `LSF_SERVERDIR`. Both variables are defined in your `lsf.conf` file. See *'LSF Variables' on page 5* for more detailed information.

Step 5 Run the following program:

```
lsadmin reconfig
```

The license file is reread and the changes accepted by LSF.

Starting the License Server Daemons at Boot Time

You must add the `lsf_license` startup script to the appropriate place on the license server hosts.

For BSD-based systems, add the path of `lsf_license` to the end of the `/etc/rc.local` file.

For HP-UX 9.x systems, you may have a BSD-style /etc/rc.local file, or you may need to add lsf_license to the /etc/rc file.

For IBM AIX systems, you may have a BSD-style /etc/rc.local, or you may need to copy the lsf_license script to the LSF_SERVERDIR directory and use smit to add $LSF_SERVERDIR/lsf_license to the list of commands run at startup time.

For System V-based systems including Sun Solaris 2 and SGI IRIX, move the lsf_license file to /etc/init.d/lsf_license and add links from the /etc/rc2.d and /etc/rc1.d directories:

```
# cp lsf_license /etc/init.d/lsf_license
# ln /etc/init.d/lsf_license /etc/rc2.d/S90lsf_license
```

On Digital UNIX and HP-UX 10.x, the instructions are similar to those for System V, but the directory names are different:

```
# cp lsf_license /sbin/init.d/lsf_license
# ln /sbin/init.d/lsf_license /sbin/rc3.d/S90lsf_license
```

CAUTION!
> **You should ensure that the `lsf_license` script runs after any NFS server scripts but before the `lsf_daemons` script in the system boot procedure.**

If you are running multiple license server hosts, configure the system startup routines to start the license server daemons on each host, and then start the daemons by hand on the backup server hosts.

Verifying License Server Status

The lmstat program can be used to check the status of the license server and determine how many licenses are available. The lmstat program requires you to give it the path to the server's license file using the -c option.

The following is a sample of what you can expect to see when you use lmstat.

```
% lmstat -a -c /usr/local/mnt/lsf/conf/license.dat

lmstat – Copyright © 1989-1997 Globetrotter Software, Inc.
Flexible License Manager status on Fri 10/24/1997 11:13


License server status: 1700@hostA

License file(s) on hostA: /usr/local/mnt/lsf/conf/license.dat:

hostA: license server UP (MASTER) v5.12

Vendor daemon status (on hostA):

lsf_ld: UP v4.1

Feature usage info:

Users of lsf_base:  (Total of 1140 licenses available)

"lsf_base" v3.100, vendor: lsf_ld
floating license

root hostB /dev/tty (v3.1) (hostA/1700 706), start Fri 10/24 10:21,
140 licenses

Users of lsf_batch:  (Total of 1150 licenses available)

"lsf_batch" v3.100, vendor: lsf_ld
floating license

root hostB /dev/tty (v3.1) (hostA/1700 806), start Fri 10/24 10:21,
138 licenses
```

```
root hostC.platform.com /dev/tty (v3.1) (hostA/1700 1301), start Fri
10/24 10:37, 18 licenses

Users of lsf_jobscheduler:  (Total of 1140 licenses available)

"lsf_jobscheduler" v3.100, vendor: lsf_ld
floating license

root hostB /dev/tty (v3.1) (hostA/1700 906), start Fri 10/24 10:21,
138 licenses

Users of lsf_jobscheduler_server:  (Total of 1140 licenses available)

"lsf_jobscheduler_server" v3.100, vendor: lsf_ld
floating license

root hostB /dev/tty (v3.1) (hostA/1700 1006), start Fri 10/24 10:21,
138 licenses

Users of lsf_multicluster:  (Total of 1140 licenses available)

"lsf_multicluster" v3.100, vendor: lsf_ld
floating license

root hostB /dev/tty (v3.1) (hostA/1700 1106), start Fri 10/24 10:21,
138 licenses
```

The output gives the status of the license server together with the vendor daemon. The usage information for each product in the license file is provided.

The License File

Software licenses are stored in a text file. The default location for this license file is:

```
/usr/local/flexlm/licenses/license.dat*
```

This may be different at your site, depending on what decisions were made when FLEXlm was initially installed.

The license file must be accessible from every host that runs licensed software. Normally, it is most convenient to place the license file in a shared directory. The variable LSF_LICENSE_FILE in the lsf.conf file should point to this location, allowing LSF to locate the license file.

An alternative to specifying a file path name in the LSF_LICENSE_FILE variable is to use "port@host" notation to indicate the name of the license server host and port being used by the lmgrd daemon. For example:

```
LSF_LICENSE_FILE="1700@hostD, 1700@hostC, 1700@hostB"
```

The port number must be the same as that specified in the license file.

5. LSF on Windows NT

This section describes how to install, configure, and license LSF on Windows NT hosts, using LSF's graphical installation tool for Windows, LSF Setup. You can also use LSF Setup to upgrade or uninstall LSF, to upgrade LSF licenses, and to add or remove hosts from a cluster.

Installation Overview

Step 1 Obtain the self-extracting executable file and a license file from Platform or your LSF vendor.

Step 2 Optional. Before you install LSF on NT, you might want to install LSF on UNIX, to make a mixed cluster.

Step 3 Extract the installation files. LSF Setup starts automatically.

Step 4 Follow the prompts.

Step 5 Optional. After installation, your new cluster only includes hosts of one type of architecture from one domain. You might want to:

- run LSF Setup again, in the same domain, to add a second architecture to the cluster (Intel Pentium or Alpha processors)

- run LSF Setup again in another domain to add hosts from another domain to the cluster

Step 6 Optional. Take additional steps to install a permanent license.

What you need to begin

This chapter assumes that you have already read Chapter 1, "LSF Installation Concepts".

Requirements for running LSF Setup

- Log onto the domain where you want to install LSF.

- Log on as a member of the Domain Admins group.

- The computer you use to run LSF Setup does not need to be an LSF host; you can use it just for installing LSF on other computers.

- Hardware:

    - Windows NT 4.0 Workstation or Server (Service Pack 3 is strongly recommended)

    - Intel Pentium 100MHz or higher speed processor, or Alpha processor of equivalent performance

Requirements for Windows NT Hosts running LSF

- Hosts must belong to a Windows NT domain.

- Hosts must have a fixed IP address. If you use DHCP to assign IP addresses dynamically, LSF can still work, provided the reassigned IP address of an LSF host does not change.

- DNS should be correctly configured on your network. Otherwise, the host file has to be set correctly on each host.

- Hardware:

    - Windows NT 4.0 Workstation or Server (Service Pack 3 is strongly recommended)

- Intel Pentium 100MHz or higher speed processor, or Alpha processor of equivalent performance
- 50MB disk space for an Intel-based host, 55MB on an Alpha-based host

Self-Extracting Executable file

LSF for Windows NT is delivered in a self-extracting executable file that automatically runs LSF Setup. There are two versions of this file, one for Intel Pentium machines and one for Alpha machines. To create a cluster that includes both types of architectures, you will need both executable files.

> `lsf3.2_nt-x86.exe` (for Windows NT on Intel Pentium)

> `lsf3.2_nt-alpha.exe` (for Windows NT on Alpha)

The files are available from your LSF vendor, and from Platform's web and FTP sites. Download or copy the executable file to any location on the network that can be accessed by the machine that will install LSF.

License file

You need a license to run LSF. Evaluation (DEMO) and permanent license keys may be requested from your LSF vendor or from Platform.

An evaluation license key is a temporary licence file that you can easily replace with a permanent licence later on. You will get a permanent license key when you purchase LSF.

LSF permanent licenses use the FLEXlm license management software from GLOBEtrotter Software, Inc. For more information, see *'License Reference' on page 109.*

Download or copy the license key to any location on the network that can be accessed by the machine that will install LSF.

Running LSF Setup for the first time

This procedure describes how to install LSF and create a new cluster that can include Windows NT hosts but will not include UNIX hosts. To create a mixed cluster of Windows NT hosts and UNIX hosts, or to modify a cluster that you have already created, read this procedure and then refer to *'Running LSF Setup to modify an existing cluster' on page 56.*

Read these instructions once before you begin the installation, and plan which computers, directories, accounts, and passwords you will use for your LSF cluster.

Note

> *LSF user accounts, including the special LSF primary administrator user account, must have a user name that does not include any spaces.*

You may need to prepare some directory structures or user accounts before you run LSF Setup. The following sections will help you understand the choices you have to make.

Starting LSF Setup

To decompress the LSF Setup program files, run the self-extracting LSF executable file.

You will be prompted to specify a directory for the installation program files. The default directory is

```
C:\Program Files\LSF Suite 3.2
```

To make a change, type the path to a new directory.

After the installation files are extracted, the LSF Setup program (`setup.exe`) runs automatically.

Setup Options

For a new installation, choose "Install LSF and create a Windows NT cluster".

LSF Products

The default products for a new installation are LSF Base and LSF Batch.

LSF User Domain

An LSF cluster may include hosts from multiple domains, but the LSF user accounts must belong to a single Windows NT domain, called the LSF user domain (which may or may not contain LSF hosts). All the user and group accounts created during the installation, including the LSF primary administrator user account, will belong to this domain.

By default, LSF Setup uses the current host domain as the LSF user domain.

To make a change, specify the name of the domain that will be the LSF user domain.

Note

> *If you change the LSF user domain, and need to create a new account or group there, make sure your logon account has administrator privileges for that domain.*

Note

> *If you are creating a cross-domain cluster, the LSF user domain has to be trusted by each LSF host domain, so that the LSF user accounts can be used by the LSF host domains.*

Note

> *If you have Backup Domain Controllers (BDCs) on your LSF user domain, we suggest using an existing account as the LSF primary administrator account, even if you have to create it before you run LSF Setup. Otherwise, until all the user databases are synchronized (every 5 minutes by default), the new user account that you create might be recognized by some controllers but not by others.*

LSF Primary Administrator User Account

LSF services run under the LSF primary administrator user account. LSF will prompt you to create a new domain account for this purpose, called `lsfadmin`.

You will be prompted to choose a password for this account. You should choose a permanent password at this point, because changing the password after installation is not easy (you would have to modify LSF services on every host individually).

You may choose to use an existing user account (any domain account in the LSF user domain) as the LSF primary administrator user account. However, the LSF primary administrator user account should be reserved for use by LSF only. Do not choose a Windows NT domain administrator, or any person's individual account.

To make a change, select "Use an existing account" and type over the default selection with the name and password of your existing account. Make sure you enter the correct password, as LSF Setup does not check this information.

Note
> *If your LSF user domain has BDCs, we recommend using an existing account.*

LSF User Group

To use products in the LSF Suite, users need the "Logon as a batch job" privilege for all the LSF server host machines. Instead of trying to enable this privilege on all relevant hosts for each user, we suggest that you let LSF enable this privilege for a global user group on all the LSF server hosts, and then add LSF users to the group after installation.

LSF Setup will prompt you to create a new group for this purpose, called `lsfusers`. The LSF cluster administrators that you specify during the installation will automatically be added to the group.

You may choose to use an existing group as the LSF user group. To make a change, select "Use an existing group" and type over the default selection with the name of the group you want to use.

LSF Administrator Groups

On Windows NT, LSF uses user groups to assign administrative privileges to LSF administrator accounts. This is done automatically; all you need to do is specify the names of the user groups.

Local LSF Administrators Group

LSF puts the LSF administrators in a local group on each host, which is then called the local LSF administrators group. The group must have same name on each host. Members of this group will be able to start and stop the LSF services.

LSF will prompt you to use a group called `LSF Local Admins`. If this group does not already exist on a host, LSF will create it. To make a change, type over the default selection with the name of the group you want to use.

Global LSF Administrators Group

Instead of adding the individual LSF administrator accounts to each local LSF administrator group, LSF adds the LSF primary administrator and other cluster administrators to a global group, then makes the global LSF administrator group a member of each local LSF administrator group. This way, changes made once to the global group affect every LSF host.

LSF will prompt you to use a group called `LSF Global Admins`. If this group does not already exist, LSF will create it. To make a change, type over the default selection with the name of the group you want to use.

Cluster Information

Cluster Name

Specify the name of the cluster that LSF Setup creates for you during installation. The default name is `cluster1`.

Note
> *The cluster name cannot include spaces.*

Cluster Administrators

Cluster administrators are able to start, stop, and configure LSF services. The LSF primary administrator user account automatically becomes a cluster administrator, but we recommend that you use a different account for regular use (to start and stop LSF services). Therefore, you must specify at least one more cluster administrator. The default is the account you are currently using.

To make a change, type over the default selection with the logon name of the user you want to be the cluster administrator. To create additional cluster administrators, type the user names separated by spaces.

Host Selection

Specify the hosts that you want to include in the cluster. Type the names of the hosts separated by spaces, or select hosts from the list (which displays name of hosts in the domain). LSF will be installed on the selected hosts.

A host cannot belong to two clusters at once. The list of available hosts includes all the hosts in your current domain, but you cannot select hosts that already have LSF installed on them.

Remember that there are two versions of LSF Setup. If your domain includes both Intel Pentium machines and Alpha machines, the list of available hosts will include them all, but you must work with one architecture at a time.

LSF Top Directory

All the LSF files are installed on one machine, which is then called the LSF file server. You should choose a computer running Windows NT Server to be your LSF file server; LSF hosts will need to access files on this machine and Windows NT Workstation only supports a limited number of connections.

On the file server, you need a special directory just for LSF files, which is then called the LSF top directory. It must be a shared network directory.

Specify the full path to the LSF top directory in UNC format. If you specify a directory that already exists, it must already be shared. If you specify a directory that does not yet exist, it must be a subdirectory of a shared directory that already exists.

Default Local Directory

By default, the same LSF binary files that are installed on the LSF file server are also copied to each LSF host. They will be installed in the same directory on each host, which is then called the default local directory. If you don't want to install the files in this directory on every host, you can change the configuration of individual hosts later.

Specify the path to a local directory where binary files can be installed on each host. The default path is `C:\LSF_32`.

If the directory you specify does not already exist on a host, LSF Setup will create it for you.

Host Configuration

Host Type

By default, each host is a server host. A server host is available to run LSF jobs, so you get the best performance from a cluster when all the machines are server hosts.

A client host only sends jobs out to run on server hosts. If a machine is very slow or hasn't got enough resources to run jobs, you should change it into a client host. To do so, select the name of the individual host from the list and choose "Client Host" instead of "Server Host".

Binary File Location

By default, LSF Setup copies LSF binary files to each host and stores them in the default local directory you specified earlier. You can install the files on a different local directory if you want to.

If you don't want to install the files locally, the host can use the files on the LSF file server or on any other LSF host, as long as the files are in a shared directory. You might notice performance problems if too many hosts use the LSF binary files on the LSF file server.

If you want a host to use binary files at a different location, select the name of the individual host from the list and specify a new path using either UNC format or drive letter convention. If you use drive letter convention, "C:\" refers to C drive on the individual host you selected (not C drive on the file server or C drive on the machine running LSF Setup). Any drive you specify this way must be a local hard drive, not a network-mapped drive.

If the LSF file server is one of the selected hosts, it will be marked with an asterisk (*). You will not be able to change to location of binary files for this host.

License Installation Options

Specify the type of license you will install (evaluation or permanent).

If you don't have a license file yet, choose "Skip this step". You can still install LSF and create the cluster, but you will have to license the software before you can use LSF to run jobs (see *'Adding or upgrading a license' on page 59*).

License File Selection

Specify the path to your license file.

If you are installing a permanent license, you will need to perform additional steps after you install LSF (see *'Permanent Licenses' on page 60*).

Summary

The LSF Setup program summarizes the configuration information for you. To make a change, click Back and return to the appropriate dialog. To complete the installation of LSF, click Next.

Running LSF Setup to modify an existing cluster

A cluster can be created by running LSF Setup just once. However, to make some changes to an existing cluster, you need to run LSF Setup again.

When describing procedures in this section, we assume that you have read *'Running LSF Setup for the first time' on page 50*. When you modify an existing cluster, you run LSF Setup as usual, but you choose a different setup option, and you must specify the LSF top directory that already exists on the LSF file server.

Building a Mixed NT/UNIX cluster

We assume that you are familiar with the requirements and procedures for installing LSF on each platform.

5

To combine UNIX hosts and Windows NT hosts in a single cluster, you must have a shared file system, so that Windows NT hosts can read and set the configuration files on the UNIX file server.

Make sure the LSF primary administrator user account is the same on UNIX and Windows NT. You might need to create these accounts before you begin.

Step 1 Create an LSF cluster on UNIX as usual.

Step 2 Log onto Windows NT as the LSF primary administrator.

Step 3 Run LSF Setup and choose "Install LSF and add to a UNIX cluster".

Step 4 Specify the location of the LSF top directory on the UNIX LSF file server.

If you see a display of port settings, it means LSF Setup could not find the current port settings for LSF daemons in the `lsf.conf` file. LSF will use the default settings which are shown on the screen.

Step 5 Install on Windows NT as usual.

Combining Intel Pentium and Alpha machines in cluster

LSF Setup can only operate on hosts of one architecture at a time.

Whenever you have hosts of both types of architectures in a domain, you need to run both versions of LSF Setup.

For example, run the Intel Pentium version of LSF Setup and install for the first time as usual, creating a cluster of Intel Pentium machines. Then run the Alpha version of LSF Setup and add Alpha hosts, following the steps in *'Adding a host' on page 58*.

If you installed the Alpha machines first, add hosts using the Intel Pentium version of LSF Setup.

Combining hosts from multiple domains in a cluster

LSF Setup can only operate on hosts in one domain at a time. Whenever you install or modify a cluster that contains multiple domains, you need to run LSF Setup separately in each domain.

Run LSF Setup for the first time as usual, creating a cluster that includes hosts from one domain. Then run LSF Setup again in the second domain, and add hosts following the steps in *'Adding a host' on page 58*.

If you cannot access your copy of LSF Setup in the first domain from the second domain, you need to install a second copy of LSF Setup in the second domain.

You may add hosts to as many additional domains as you choose. For better performance and stability, we recommend storing LSF binary files locally, or on a host in the same domain, rather than on the LSF file server in another domain.

Adding a host

Step 1   Log onto the domain containing the hosts that you want to add to the cluster.

Step 2   Run LSF Setup and choose "Add or remove hosts".

Step 3   Choose "Add Hosts".

Step 4   In the Host Selection dialog, select only the hosts that you want to add to the cluster. LSF will be installed on the selected hosts.

        Hosts that already have LSF installed may appear in the list of available hosts, but they should not be selected for the "Add hosts" operation.

Removing a host

Step 1   Log onto the domain containing the hosts that you want to remove from the cluster.

Step 2   Run LSF Setup and choose "Add or remove hosts".

Step 3   Choose "Remove LSF from hosts".

Step 4   In the Host Selection dialog, select only the hosts that you want to remove from the cluster. LSF will be removed from the selected hosts.

Adding or upgrading a license

Step 1   Copy your license file to a hard drive on your system.

Step 2   Run LSF Setup and choose "Add/Upgrade License". If your cluster is already licensed, the old license file is replaced by the new one.

Upgrading LSF

Step 1   Run LSF Setup and choose "Upgrade LSF from a previous version".

Step 2   In the Host Selection dialog, select the hosts that you want to upgrade.

By default, LSF Setup automatically selects all the NT hosts listed in the cluster configuration file. However, if the cluster configuration file has been modified, or if LSF Setup has any problem reading the cluster configuration file, you will have to make corrections to the default selections.

Note

If you have LSF version 3.0 or earlier, you cannot use LSF Setup to upgrade. You must uninstall the old version completely, and then install the new version.

Uninstalling LSF

The setup option "Add or remove hosts" cannot remove LSF from the LSF file server. To completely remove an LSF cluster, use the option "Uninstall LSF Suite", which can remove LSF from hosts in the domain and also removes the LSF files on the LSF file server.

LSF must be removed from all the hosts before it is removed from the LSF file server. If your LSF cluster includes multiple domains, this means using the Remove option to remove hosts on all but one domain, and using the Uninstall option only on the last domain (the one that contains the LSF file server).

Step 1 If your LSF cluster includes multiple domains, follow the steps in *'Removing a host' on page 58* and remove all the hosts from every domain except for the domain that contains the LSF file server.

Step 2 If you have hosts of DEC Alpha and Intel Pentium architectures on the same domain as the file server, follow the steps in *'Removing a host' on page 58* and remove all the hosts that are not the same type as the LSF file server.

Step 3 Log onto the domain that contains the LSF file server. Run LSF Setup and choose "Uninstall LSF Suite".

Step 4 In the Host Selection dialog, select the LSF file server and any remaining hosts. After this step, LSF will be removed completely.

After Installation

After you have completed the installation of LSF on the desired hosts in your domain, each LSF host will have a Start/Program folder bearing the name "LSF Suite for Workload Management". All LSF-related icons are under this folder.

This section describes the steps you must take before you can start using LSF.

Step 1 If you have a permanent license, install and start FLEXlm.

Step 2 Enable the LSF environment variables.

Step 3 Start LSF service and daemons on LSF server hosts.

Step 4 Set up LSF user passwords and privileges.

Permanent Licenses

If you have a permanent license, you need to install and start FLEXlm before starting the LSF Service and daemons .

To install FLEXlm as a Windows NT service on the license server host, take the following steps:

Step 1 Log on to the license server host and open a command shell.

Step 2 Go to the `c:\flexlm\bin` directory and type the following:

```
install c:\flexlm\bin\lmgrd.exe
```

LSF Setup has already created the `c:\flexlm` directory and copied all the necessary files to it.

To start the FLEXlm License daemon, restart the machine, or choose "Services" in the Windows NT Control Panel on your license server host.

Environment Variables

For each host, LSF Setup makes changes to the system environment variables LSF_ENVDIR and PATH during the installation. Restart each machine to make the new environment effective for all users.

You may choose not to restart a machine at this time. If so, log off and log on again to make these changes take effect locally. However, other users, such as those who telnet to the machine, will not be able to use LSF until you restart.

Starting LSF

The LSF service and daemons on each LSF server host will start automatically when the machine is restarted.

If you cannot restart each host at this time, log on as an LSF cluster administrator (a member of the LSF Global Administrators group) and start the LSF service and daemons manually.

Note
> *You should not use the primary LSF administrator's account (normally* `lsfadmin`*) to start or stop LSF service and daemons.*

To start the LSF service and daemons, use any one of the following methods:

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- Use the Windows NT Server Manager to start "LSF Service" on all LSF server hosts.

- Click "Services" on the Windows NT Control Panel and start "LSF Service". You will have to repeat this step on each LSF server host.

- Where LSF Batch has been installed, go to the "LSF Suite for Workload Management/LSF Batch" program folder, and use the LSF administrative tool "LSF Batch Administration". (You can use this tool to perform all your administrative tasks for LSF Base and LSF Batch products.)

- Start a new command console, and type:

      lssrvcntrl start -m all lssrvman

   Usage information for `lssrvcntrl` is available by typing `lssrvcntrl` with no options.

User Setup

When LSF users log onto the LSF user domain, they must use a domain user account, not a local user account. LSF needs the password of each domain user account. Enter the passwords using the `lspasswd.exe` command, and follow the instructions. For example:

lspasswd [-u user_name]

If you do not specify the -u option, the password applies to the current user account.

In addition, all LSF users need to have the "Logon as a batch job" privilege on every LSF server host. To make this simple, put all LSF users into the LSF user group, since user accounts in the LSF user group have the necessary privileges enabled automatically.

6. After Installation

This section describes the procedures that must be used to start up the LSF daemons, test the LSF cluster configuration, and provide LSF to users at your site. These procedures cannot be performed until after the LSF software has been installed and the hosts have been configured individually (see *'Default Installation' on page 13* or *'Custom Installation' on page 23*).

Checking Cluster Configuration

Before you can start any LSF daemons, you should make sure that your cluster configuration is correct. The `lsfsetup` program includes an option to check the LSF configuration. The default LSF configuration should work as it is installed following the steps described in *'Default Installation Procedures' on page 14*.

Step 1   Log into the first host listed in `lsf.cluster.`*`cluster`*, (*cluster* is the name of the cluster) as the LSF administrator.

Step 2   Check the LIM configuration by entering the following command:

```
lsadmin ckconfig -v
```

The `lsadmin` program is located in the `LSF_TOP/bin` directory.

Step 3   Check the output of the command to make sure there are no errors.

The output should look something like the following:

```
Checking configuration files ...
LSF v3.1, Sept 10, 1997
Copyright 1992-1997 Platform Computing Corporation
Reading configuration from /etc/lsf.conf
```

```
Dec 21 21:15:51 13412 /usr/local/lsf/etc/lim -C
Dec 21 21:15:52 13412 initLicense: Trying to get license for LIM from source
</usr/local/lsf/conf/license.dat>
Dec 21 21:15:52 13412 main: Got 1 licenses
Dec 21 21:15:52 13412 main: Configuration checked. No fatal errors found.
--------------------------------------------------------
No errors found.
```

The messages shown above are the normal output from
lsadmin ckconfig -v. Other messages may indicate problems with the
LSF configuration.

Checking Batch Daemon Configuration

Both LSF Batch and LSF JobScheduler require this check to be made.

To check the LSF Batch configuration files, LIM must be running on the master host.

Step 1 If the LIM is not running, log in as root and start LSF_SERVERDIR/lim.

Step 2 Wait a minute, and then run the lsid program to make sure LIM is available.

The **lsid** program is located in the LSF_TOP/bin directory.

Step 3 Check the batch configuration by entering the following command:

badmin ckconfig -v

The output should look something like the following:

```
Checking configuration files ...
Dec 21 21:22:14 13545 mbatchd: LSF_ENVDIR not defined; assuming /etc
Dec 21 21:22:15 13545 minit: Trying to call LIM to get cluster name ...
Dec 21 21:22:17 13545 readHostFile: 3 hosts have been specified in file
</usr/local/lsf/conf/lsbatch/test_cluster/configdir/lsb.hosts>; only these
hosts will be used by lsbatch
Dec 21 21:22:17 13545 Checking Done
--------------------------------------------------------
No fatal errors found.
```

Step 4 Check the output of the command to make sure there are no errors.

The above messages are normal; other messages may indicate problems with the LSF configuration.

Starting the LSF Daemons

The LSF daemons can be started using the `lsf_daemons` program. This program must be run from the `root` account, so if you are starting daemons for a private cluster, do not use `lsf_daemons`: start the daemons manually instead.

Step 1 Start the LSF daemons by running the following command:

```
lsf_daemons start
```

Step 2 Check that `res`, `lim` and `sbatchd` processes have started using the `ps` command.

If you choose, you can start LSF daemons for all machines using the `lsadmin` and `badmin` commands. Do this by executing the following commands in order, instead of using the `lsf_daemons` command.

```
lsadmin limstartup
```

```
lsadmin resstartup
```

```
badmin hstartup
```

`lsfsetup` creates a default LSF Batch configuration (including a set of batch queues) which is used by both LSF Batch and LSF JobScheduler. You do not need to change any LSF Batch files to use the default configuration.

Testing the LSF Cluster

After you have started the LSF daemons in your cluster, you should run some simple tests. Wait a minute or two for all the LIMs to get in touch with each other, to elect a master, and to exchange some setup information.

The testing should be performed as a non-root user. This user's `PATH` must include the LSF user binaries (`LSF_BINDIR` as defined in LSF_ENVDIR/`lsf.conf`).

Testing consists of running a number of LSF commands and making sure that correct results are reported for all hosts in the cluster. This section shows suggested tests and examples of correct output. The output you see on your system will reflect your local configuration.

The following steps may be performed from any host in the cluster.

Testing LIM

Step 1   Check cluster name and master host name:

```
% lsid
LSF 3.1, Dec 10, 1997
Copyright 1992-1997 Platform Computing Corporation

My cluster name is test_cluster
My master name is hostA
```

The master name may vary but is usually the first host configured in the `Hosts` section of the `lsf.cluster.`*cluster* file.

If the LIM is not available on the local host, `lsid` displays the following message:

```
lsid: ls_getmastername failed: LIM is down; try later
```

If the LIM is not running, try running `lsid` a few more times.

The error message

```
lsid: ls_getmastername failed: Cannot locate master LIM now, try later
```

means that local LIM is running, but the master LIM has not contacted the local LIM yet. Check the LIM on the first host listed in `lsf.cluster.`*`cluster`*. If it is running, wait for 30 seconds and try `lsid` again. Otherwise, another LIM will take over after one or two minutes.

Step 2 The `lsinfo` command displays cluster-wide configuration information.

```
% lsinfo
RESOURCE_NAME   TYPE      ORDER   DESCRIPTION
r15s            Numeric   Inc     15-second CPU run queue length
r1m             Numeric   Inc     1-minute CPU run queue length (alias: cpu)
r15m            Numeric   Inc     15-minute CPU run queue length
ut              Numeric   Inc     1-minute CPU utilization (0.0 to 1.0)
pg              Numeric   Inc     Paging rate (pages/second)
ls              Numeric   Inc     Number of login sessions (alias: login)
it              Numeric   Dec     Idle time (minutes) (alias: idle)
tmp             Numeric   Dec     Disk space in /tmp (Mbytes)
mem             Numeric   Dec     Available memory (Mbytes)
ncpus           Numeric   Dec     Number of CPUs
maxmem          Numeric   Dec     Maximum memory (Mbytes)
maxtmp          Numeric   Dec     Maximum /tmp space (Mbytes)
cpuf            Numeric   Dec     CPU factor
type            String    N/A     Host type
model           String    N/A     Host model
status          String    N/A     Host status
server          Boolean   N/A     LSF server host
cserver         Boolean   N/A     Compute Server
solaris         Boolean   N/A     Sun Solaris operating system
fserver         Boolean   N/A     File Server
NT              Boolean   N/A     Windows NT operating system

TYPE_NAME
hppa
SUNSOL
alpha
sgi
NTX86
rs6000
```

```
MODEL_NAME           CPU_FACTOR
HP735                4.0
ORIGIN2K             8.0
DEC3000              5.0
PENT200              3.0
```

The resource names, host types, and host models should be those configured in LSF_CONFDIR/lsf.shared.

Step 3 The lshosts command displays configuration information about your hosts:

```
% lshosts
HOST_NAME type    model     cpuf  ncpus  maxmem  maxswp  server  RESOURCES
hostA     hppa    HP735     4.00  1      128M    256M    Yes     (fserver hpux)
hostD     sgi     ORIGIN2K  8.00  32     512M    1024M   Yes     (cserver)
hostB     NTX86   PENT200   3.00  1      96M     180M    Yes     (NT)
```

The output should contain one line for each host configured in the cluster, and the type, model, and RESOURCES should be those configured for that host in lsf.cluster.*cluster*. cpuf should match the CPU factor given for the host model in lsf.shared.

Step 4 Check the current load levels:

```
% lsload
HOST_NAME  status  r15s  r1m  r15m   ut    pg   ls  it   tmp   swp   mem
hostA      ok      0.3   0.1  0.0    3%    1.0  1   12   122M  116M  56M
hostD      ok      0.6   1.2  2.0    23%   3.0  14  0    63M   698M  344M
hostB      ok      0.6   0.3  0.0    5%    0.3  1   0    55M   41M   37M
```

The output contains one line for each host in the cluster.

If any host has unavail in the status column, the master LIM is unable to contact the LIM on that host. This can occur if the LIM was started recently and has not yet contacted the master LIM, or if no LIM was started on that host, or if that host was not configured correctly.

If the entry in the status column begins with - (for example, -ok), the RES is not available on that host. RES status is checked every 90 seconds, so allow enough time for STATUS to reflect this.

If all these tests succeed, the LIMs on all hosts are running correctly.

Testing RES

Step 1   The `lsgrun` command runs a UNIX command on a group of hosts:

```
% lsgrun -v -m "hostA hostD hostB" hostname
<<Executing hostname on hostA>>
hostA
<<Executing hostname on hostD>>
hostD
<<Executing hostname on hostB>>
hostB
```

If remote execution fails on any host, check the RES error log on that host.

Testing LSF Batch

Testing consists of running a number of LSF commands and making sure that correct results are reported for all hosts in the cluster.

Step 1   The `bhosts` command lists the batch server hosts in the cluster:

```
% bhosts
HOST_NAME    STATUS    JL/U  MAX  NJOBS  RUN  SSUSP USUSP  RSV
hostD        ok        -     10   1      1    0     0      0
hostA        ok        -     10   4      2    2     0      0
hostC        unavail   -     3    1      1    0     0      0
```

The STATUS column shows the status of `sbatchd` on that host. If the STATUS column contains `unavail`, that host is not available. Either the `sbatchd` on that host has not started or it has started but has not yet contacted the `mbatchd`. If hosts are still listed as unavailable after roughly three minutes, check the error logs on those hosts.

See the `bhosts(1)` manual page for explanations of the other columns.

6 After Installation

Step 2 Submit a job to the default queue:

```
% bsub sleep 60
Job <1> is submitted to default queue <normal>
```

If the job you submitted was the first ever, it should have job ID 1. Otherwise, the number varies.

Step 3 Check available queues and their configuration parameters:

```
% bqueues
QUEUE_NAME    PRIO   STATUS        MAX  JL/U JL/P JL/H NJOBS  PEND  RUN  SUSP
interactive   400    Open:Active   -    -    -    -    1      1     0    0
fairshare     300    Open:Active   -    -    -    -    2      0     2    0
owners        43     Open:Active   -    -    -    -    0      0     0    0
priority      43     Open:Active   -    -    -    -    29     29    0    0
night         40     Open:Inactive -    -    -    -    1      1     0    0
short         35     Open:Active   -    -    -    -    0      0     0    0
normal        30     Open:Active   -    -    -    -    0      0     0    0
idle          20     Open:Active   -    -    -    -    0      0     0    0
```

See the bqueues(1) manual page for an explanation of the output.

Step 4 Check job status.

```
% bjobs
JOBID USER  STAT QUEUE  FROM_HOST EXEC_HOST  JOB_NAME SUBMIT_TIME
1     fred  RUN  normal hostA     hostD      sleep 60 Dec 10 22:44
```

Note that if all hosts are busy, the job is not started immediately so the STAT column says PEND. This job should take one minute to run. When the job completes, you should receive mail reporting the job completion.

Configuring LSF MultiCluster

You do not need to read this section if you are not using the LSF MultiCluster product.

LSF MultiCluster unites multiple LSF clusters so that they can share resources transparently, while at the same time, still maintain resource ownership and autonomy of individual clusters.

LSF MultiCluster extends the functionality of a single cluster. Configuration involves a few more steps. First you set up a single cluster as described above, then you need to do some additional steps specific to LSF MultiCluster.

Configuring LSF JobScheduler

You do not need to read this section if you are not using the LSF JobScheduler product.

LSF JobScheduler provides reliable production job scheduling according to user specified calendars and events. It runs user-defined jobs automatically at the right time, under the right conditions, and on the right machines.

The configuration of LSF JobScheduler is almost the same as that of the LSF Batch cluster, except that you may have to define system-level calendars for your cluster and you might need to add additional events to monitor your site.

Providing LSF to Users

When you have finished installing and testing LSF cluster, you can let users try it out. LSF users must add LSF_BINDIR to their PATH environment variables to run the LSF utilities.

Users also need access to the on-line manual pages, which were installed in LSF_MANDIR (as defined in `lsf.conf`) by the `lsfsetup` installation procedure. For

most versions of UNIX, users should add the directory LSF_MANDIR to their MANPATH environment variable. If your system has a `man` command that does not understand `MANPATH`, you should either install the manual pages in the `/usr/man` directory or get one of the freely available `man` programs.

Note

> *The* `/etc/lsf.conf` *file (or LSF_CONFDIR/*`lsf.conf` *if you used the Default installation procedure) must be available.*

Using `xlsadmin`

You can use the `xlsadmin` graphical tool to do most of the cluster configuration and management work that has been described in this chapter.

7. Installing an Additional Host Type

This section describes the procedure for installing LSF software for any additional host type after the LSF software for the initial host type has been installed. You can install LSF products for as many types of host as you plan to use in your LSF cluster: the procedure is the same in each case.

In this section of the *LSF Installation Guide*, you will find procedures for:

*   acquiring one or more additional LSF distribution files, either via download from Platform's WWW or FTP sites or from hard media

*   uncompressing the distribution file and extracting its contents, which creates the distribution directory

*   determining whether the initial installation was default or custom

*   copying the existing `lsf.conf` file to the appropriate directory (this step is skipped for default installations)

*   running `lsfsetup` and installing the LSF software for the additional host type

Additional Distribution File(s)

You will need to obtain one LSF distribution file for each additional host type you are installing in the cluster. For example, if you are adding the HP-UX, IRIX, and SOLARIS host types to an existing LSF cluster, you must obtain three LSF distribution files, one for each of these host types.

For instructions on obtaining distribution files and for creating the LSF distribution directory, see *'LSF Distribution Files' on page 8*.

Checking the Initial Installation

Because LSF has two software installation procedures—default and custom—there are two corresponding paths that may be taken when adding an additional host type. Which path you take depends on which path was followed when the initial LSF host type(s) was(were) installed.

If LSF was originally installed using the default installation procedure, you can now add a host type to the installation using either the default or custom procedures. If you still accept the assumptions made by the default installation, it is recommended that you use it again.

If LSF was originally installed using the custom installation procedure, you **must use the custom installation procedure to add a host type.**

If you aren't sure how the original installation was done, you can check LSF's configuration file, `lsf.conf` to find out.

Step 1 Open your existing `lsf.conf` file with any text editing or viewing program.

This placement of this file depends upon decisions made during the initial installation, but it is placed in the `LSF_SERVERDIR` directory by default in all cases but one—if you used the default installation procedure, it is stored in the `LSF_CONFDIR` directory.

Step 2 Search the file, using a search function or simply by glancing through it, for the following variable:

`LSF_DEFAULT_INSTALL=`

If this variable is set to "y", then the initial LSF installation was a default installation. If this variable is set to "n", then the initial LSF installation was a custom installation.

Adding a Host Type

Once you have created the distribution directory, and know how the initial installation was done, you can proceed to install the software for the additional host type. Two procedures are given here: one is for adding a host type using the default install (when the initial installation was done using the default installation procedure), and one is for adding a host type using the custom install.

Default Procedure

Step 1   Log in to the file server host as `root`.

Step 2   Change directory to the distribution directory.

Step 3   Run the `./lsfsetup` program.

LSF's install utility starts up, and its main menu is displayed.

Step 4   Choose option 1, 'Default Install'.

Step 5   Specify the directory into which the first LSF host type was installed.

The setup utility will detect that the initial host type has been installed, and proceed to install the host type specific files for the host type you are installing now.

The setup utility will also look for an existing license key, the `license.dat` file.

Step 6   If the `lsfsetup` program detects an existing license key, simply allow the installation to proceed. If you did not install a license key when you installed the initial (or any subsequent) additional host type, you will be prompted to install it now.

If you do not want to install your license key now for any reason, or you have not yet obtained it from your LSF vendor, you can install it later by running the `lsfsetup` program and choosing option 4, 'License Management'.

7　Installing an Additional Host Type

Detailed instructions and information on installing a license key this way are contained in *'License Installation' on page 33*.

Step 7　If you want to install your license key now, indicate where you have placed it.

The `lsfsetup` program determines whether the license is a DEMO or a permanent license.

If it is a DEMO license, it is copied into the `LSF_CONFDIR`. If it is a permanent license, a menu of choices is displayed, from which you can select the appropriate action. For more information, see *'License Installation' on page 33*.

Step 8　Allow the installation to proceed.

You are informed when the installation for this host type is finished.

If you are not installing LSF on any other additional host types, you can continue with *'Adding an Additional Host to an Existing Cluster' on page 79* for instructions on how to complete your LSF installation and setup. If you need to install LSF for an additional host type, repeat the steps in this section once for each additional host type.

Custom Procedure

Step 1　Log in to the file server host as `root`.

Step 2　Change directory to the distribution directory.

Step 3　Run the `./lsfsetup` program.

LSF's install utility starts up, and its main menu is displayed.

Step 4　Choose option 2, 'Custom Install'.

Step 5　Choose option 2, 'Install Another Host Type'.

Step 6　Confirm the location of the LSF configuration file (`lsf.conf`)—created when you installed the initial host type.

Step 7　Specify the `LSF_MACHDEP` directory (specified when you installed the previous host type(s), default value `/usr/local/lsf`).

The other installation settings are automatically updated.

Step 8   Choose option 3, 'Install the Software Now'.

The `lsfsetup` program installs all the products necessary for the additional host type.

You are informed when the installation for this host type is finished.

If you are not installing LSF on any other additional host types, you can continue with *'Adding an Additional Host to an Existing Cluster' on page 79* for instructions on how to complete your LSF installation and setup. If you need to install LSF for an additional host type, repeat the steps in this section once for each additional host type.

Next Steps

Once you have installed the software for the additional host types, you can proceed to set up individual hosts in the cluster. Procedures for this are given in *'Adding an Additional Host to an Existing Cluster' on page 79*.

8. Adding an Additional Host to an Existing Cluster

This section of the LSF installation documentation describes how to add another host machine to an existing LSF cluster, any time after the initial installation and setup. The procedures contained in this section assume that an LSF cluster is installed, configured, and running correctly at your site. Adding an additional host to your LSF cluster at this point involves most of the same steps that were required to add hosts when LSF was installed initially.

You do not need to shut down the LSF daemons before you add another host to the cluster. LSF can continue to operate while you configure the new machine.

This section of the LSF installation documentation set describes how to:

•   make sure that you have installed the LSF files specific to the host type of the host you are adding

•   mount the appropriate LSF directories on the new host machine from the LSF server host

•   execute the 'Host Setup' procedures in the `lsfsetup` program, on each LSF host in the cluster, to:

    •   create symbolic links to host type specific directories, allowing all hosts to access the host type specific LSF binary files using the same path

    •   create a symbolic link to the LSF configuration file `lsf.conf`, simplifying setup and maintenance by allowing all hosts to access the same configuration file

    •   modify the host's startup files so that the LSF daemons start automatically when the machine boots up

- • check to see where the LSF service ports have been registered, and if they have been registered correctly

- • add information about the new host to the `lsf.cluster.`*`cluster`* file

- • tell LSF to read the new cluster configuration which includes information for the host(s) you are adding

Note

If you are using LSF's custom installation procedure, you must create the symbolic links to host type specific directories manually rather than using the `lsfsetup` *program.*

Host Types and Distribution Files

Adding a host to an existing LSF cluster after initial installation and setup is done, for the most part, the same way as adding hosts to the cluster at install time.

The primary difference is that when you add one or more new hosts later on, you must find out if they are hosts of the same type as those currently in the cluster. If they are not, you must obtain the LSF distribution file for the host type of the host machine being added, and install those LSF files before adding the new host.

You can check this in the following way.

Step 1   Identify the host type of the host machine you want to add to the LSF cluster.

Step 2   Log in to any host in the cluster (you need not be `root`).

Step 3   Change directory to the LSF_MACHDEP subdirectory (this is `/usr/local/lsf` by default).

     This is the directory that contains all host type dependent LSF files, which include programs, daemons, and libraries compiled for a specific type of host machine. These files can be shared by all hosts of the same type in the cluster.

More information on the `LSF_MACHDEP` directory can be found in *'LSF Directory Structure' on page 3*.

Step 4   List the contents of this directory.

If the appropriate host type is currently installed, there will be a subdirectory bearing the name of the host type.

If the appropriate host type is not currently installed, there will be no subdirectory bearing its name, and you will have to obtain the appropriate LSF distribution file and install the software.

Instructions for installing software for another LSF host type after the initial installation and setup are contained in *'Adding a Host Type' on page 75*.

If the LSF software appropriate for the host type of the host machine you are adding to the cluster, continue with the steps in the next section, *'Host Setup Procedures'*.

Host Setup Procedures

Once you know that the LSF software appropriate for the host type of the host machine you are adding to the cluster has been installed, you can follow the host setup procedures in *'LSF Host Setup' on page 19*.

You should repeat this procedure for each host that you want to add to an existing LSF cluster. When you have finished setting up all the hosts you are adding to your cluster, you can move on to the next section, *'Adding Host Information to the Cluster Configuration File'*.

Adding Host Information to the Cluster Configuration File

After you have successfully run the `lsfsetup` program's Host Setup functions on the host you are adding to the cluster, you must add information about the new host (such as its name, for example) to your cluster's configuration file, `lsf.cluster.cluster_name`. This file is located in the LSF_CONFDIR directory.

Step 1 If you aren't already, log in to the LSF host as `root`.

Step 2 Run the `lsfsetup` program.

It has been installed in the `LSF_MACHDEP/etc` directory.

Step 3 Select option 2, 'Custom Install'.

Step 4 Select option 3, 'Configure LSF Cluster'.

You will be prompted to confirm the location of the LSF configuration file (`lsf.conf`) you want to use to set up the new host.

During installation, the `lsfsetup` command created the `lsf.conf` file in the `LSF_SERVERDIR` based on your decisions.

Step 5 Confirm that `lsfsetup` has found the correct configuration file, or enter a path to the correct one if, for any reason, the path displayed is incorrect.

Step 6 Select option 1, 'View/Add/Delete/Modify Currently Configured Hosts'.

Step 7 Select option 2, 'Add Hosts to LSF Configuration'.

You are prompted to input the name of the host you are adding to the cluster.

The **vi** text editor is started on the LSF configuration file where the host thresholds are configured.

Step 8 Edit the configuration line for the host you are adding, setting its type, model, load thresholds, and resources as desired.

You may want to use the default values for that host type now, and change them later on when you have more experience or more information. This can be done without interrupting LSF service.

Step 9 When you are finished working with the configuration file, exit and save your changes.

Once you have entered all desired host information into the configuration file, you can proceed to the next section, *'Reconfiguring the Cluster'*.

Reconfiguring the Cluster

After changing the cluster configuration file to include the information for the new host(s), you must tell LSF that it should reread the file to pick up the changes.

Step 1 If you aren't already, log in to the LSF host as `root`.

Step 2 Run the following program:

`lsadmin reconfig`

This program is found in the `LSF_TOP/bin` directory.

Running `lsadmin` this way causes LSF to check the configuration file for errors. If no errors are found, a message indicating this is displayed, and you are asked if you want to restart LSF's LIMs on all hosts, and reconfigure the LIM daemons.

Step 3 Select the [y] option.

The changes to the configuration files are committed. Once you have successfully completed this step, you can proceed to *'Starting LSF Servers at Boot Time' on page 86*.

Registering LSF Service Ports

LSF uses UDP and TCP ports for communication. All hosts in the cluster must use the same port numbers so that each host can connect to the servers on other hosts. There are three alternative places to configure the port numbers for the LSF services:

- The `/etc/services` file.

- The services NIS (Network Information Service or Yellow Pages) or NIS+ database.

- Configuration parameters in the `/etc/lsf.conf` file.

To determine which is used in your system, run the command `ypwhich -m services`. If this command displays a host name, your network is using NIS. On Solaris 2.3 systems, run the command:

```
% nismatch name=login services.org_dir
```

If this command returns a service entry for the login service, your network is using NIS+.

The Host Setup option in the `lsfsetup` command tries to find out where the services should be registered. If the services database is in the `/etc/services` file, `lsfsetup` adds the LSF services to that file.

If your services database is in an NIS or NIS+ database, you must add the entries to your database by hand. The following is the contents of the `example.services` file provided in the distribution directory. This file contains examples of the entries you must add to the services database.

```
# /etc/services entries for LSF daemons.
#
res     3878/tcp # remote execution server
lim     3879/udp # load information manager
mbatchd 3881/tcp # master lsbatch daemon
sbatchd 3882/tcp # slave lsbatch daemon
#
# Add this if ident is not already defined
```

```
# in your /etc/services file
ident 113/tcp auth tap # identd
```

CAUTION!

> **Some NIS implementations fail if the NIS source file contains blank lines, causing many system services to become unavailable. Make sure that all the lines you add either contain valid service entries or begin with a comment character '#'.**

If any other service listed in your services database has the same port number as one of the LSF services, you can change the port number for the LSF service. You must use the same port numbers on every LSF host.

NIS Services Database

If you are running NIS, you only need to modify the services database once per NIS master. On some hosts the NIS database and commands are in the `/var/yp` directory; on others NIS is found in `/etc/yp`. Follow these steps:

Step 1 Run the `ypwhich -m services` command to find the name of the NIS master host.

Step 2 Log in to the NIS master host as `root`.

Step 3 Edit the `/var/yp/src/services` or `/etc/yp/src/services` file on the NIS master host and add the contents of the `example.services` file.

Step 4 Change directory to `/var/yp` or `/etc/yp.`

Step 5 Run the following command:

> % **ypmake services**

> On some hosts the master copy of the services database is stored in a different location; refer to your system documentation for more information.

> On systems running NIS+ the procedure is similar; again, please refer to your system documentation.

Configuring Services in `lsf.conf`

If you do not want to change the /etc/services file or the NIS database, you can
configure the service port numbers in the lsf.conf file (typically installed in /etc).
Edit the lsf.conf file and add the following lines:

```
LSF_RES_PORT=3878
LSF_LIM_PORT=3879
LSB_MBD_PORT=3881
LSB_SBD_PORT=3882
LSF_ID_PORT=113
```

You must make sure that the same entries are added to the /etc/lsf.conf file on
every host.

Starting LSF Servers at Boot Time

The lsfsetup Host Setup procedure normally configures each LSF server host to start
the LSF daemons when the host boots. This section describes the changes lsfsetup
makes to your system, and describes how to perform this setup by hand.

The LSF daemons must be run by root on every server host in the cluster. The steps
required to set up daemons are different under different versions of UNIX. In any case,
the LSF daemons should be started after all other networking and NFS daemons, and
after the filesystems containing the LSF executables and configuration files are
available.

On BSD-based UNIX systems such as ULTRIX, SunOS 4, and ConvexOS, the startup
commands should be placed at the end of the /etc/rc.local script. lsfsetup adds
the following text to the /etc/rc.local script to start the daemons:

```
# %LSF_START% Start LSF daemons
/usr/local/lsf/etc/lsf_daemons start
# %LSF_END%
```

On HP-UX 9.x, you should add the above command to the `localrc` function in the `/etc/rc` file. If your site has created a local startup file such as `/etc/rc.local`, you should put the startup command into that file instead.

On System V- and POSIX-based systems such as Digital UNIX, Solaris, SGI IRIX, and HP-UX 10.x, daemons are started and stopped by scripts in the `/etc/init.d` and `/etc/rc*.d`, or `/sbin/init.d` and `/sbin/rc*.d`, directories. `lsfsetup` links the `LSF_SERVERDIR/lsf_daemons` script file from the distribution into the appropriate place depending on the run state defined in `/etc/inittab`. If the `/etc/init.d` directory exists, `lsfsetup` creates symbolic links in the `/etc` directories; if `/sbin/init.d` exists, the links are created in `/sbin`. As an example, `lsfsetup` will create the following links if the run state in `/etc/inittab` is defined as 3:

```
# ln -s /usr/local/lsf/etc/lsf_daemons /etc/init.d/lsf
# ln -s /etc/init.d/lsf /etc/rc3.d/S95lsf
```

Note

> *The LSF daemons must be started on every server host in the LSF cluster.*

9. Upgrading LSF

This chapter describes the procedure for upgrading LSF from an older version to the current one. The upgrade procedure replaces the installed binaries and daemons, and automatically updates your configuration files to support LSF 3.2, if necessary.

Obtaining the Distribution File(s)

You will need to obtain one LSF distribution file for each host type in the cluster you are upgrading. For example, if you are upgrading an LSF cluster that includes host machines running HP-UX, IRIX, and SOLARIS operating systems, you must obtain three LSF distribution files, one for each of these.

See *'LSF Distribution Files' on page 8* for information on obtaining LSF distribution files and creating the LSF distribution directory.

Upgrading the License Key

When you upgrade LSF to 3.2, you will have to upgrade your license key as well, so that the license server will support the new version. Because the license key names contained in the license file have changed in LSF 3.2, old (i.e. version 3.1) `license.dat` files are incompatible.

If you received a DEMO license key, you can proceed directly with the installation. To get a permanent license from your LSF vendor, see the Release Notes or *'Getting License Key Information' on page 34*. You can install LSF with a DEMO license key and change to a permanent license later with no interruption in service.

Instructions for upgrading your license key are contained in *'Updating an LSF License' on page 41*.

The Upgrade Procedure

This section describes the procedure for installing LSF when you already have a previous version of LSF installed on your system.

The upgrade procedure replaces the installed binaries and the running daemons, and automatically updates your configuration files to support the new LSF version, if necessary.

CAUTION!
> **All interactive jobs running under LSF will be killed. Make sure that the system is completely idle before upgrading LSF—including the graphical applications!**

You should do a complete backup of your LSF binaries and configuration files before upgrading LSF.

Step 1   Shut down all LSF daemons and make sure there are no currently running jobs.

Step 2   Copy the LSF configuration file from the previous version to the distribution directory.

       This means you should copy the `/etc/lsf.conf` file created by the previous installation.

Step 3   Log in to an LSF server host as `root`.

Step 4   Change directory to the distribution directory you have created for the LSF upgrade.

Step 5   Run the `./lsfsetup` command.

Step 6   Choose option 5, 'Upgrade From a Previous Version'.

A product selection menu is displayed.

Step 7 Specify one or more of the products to install.

Remember that if you choose more than one, you must separate them with commas.

You are prompted to indicate where the configuration file (**lsf.conf**) for the existing version of LSF is located.

Step 8 Specify the configuration file describing the old installation.

Step 9 The upgrade procedure now follows the standard lsfsetup installation procedure as described in *'Default Installation Procedures' on page 14* or *'Custom Installation Procedures' on page 24*. You should review the installation settings and modify them, if necessary, before installing the software.

Perform the upgrade procedure once for each host type. The lsfsetup command automatically upgrades the necessary portions of LSF for each host type.

Step 10 Restart the LSF daemons on all hosts.

10. Adding a Product

This chapter describes the procedure for installing additional LSF products after an initial LSF installation.

This section of the LSF installation documentation contains procedures for:

- locating or obtaining the appropriate distribution file(s) for LSF

- uncompressing the distribution file and extracting the installation files from it

- updating your license key

- installing the new product using LSF's installation program, `lsfsetup`

LSF Distribution Files

You will need to obtain one LSF distribution file for each host type in the cluster to which you are adding an LSF product. For example, if you are adding a product to an LSF cluster that includes host machines running HP-UX, IRIX, and SOLARIS operating systems, you must obtain three LSF distribution files, one for each of these.

See *'LSF Distribution Files' on page 8* for information on obtaining LSF distribution files and creating the LSF distribution directory.

Updating the License Key

When you add an LSF product to an existing installation, you will have to update your license key as well, so that the license server will support the new product. In this case, you may be provided with an INCREMENT license key or a new PRODUCT line.

To install an LSF INCREMENT license key or a new FEATURE line:

Step 1 Edit your `license.dat` file using a text editor like vi or emacs (UNIX) or Notepad (Windows NT).

Step 2 Add the INCREMENT line immediately after the PRODUCT line in the `license.dat` file.

Step 3 Save the file.

Step 4 Run the following program:

```
lmreread -c <LSF_LICENSE_FILE>
```

The `lmreread` program is found in your `LSF_SERVERDIR`. Both variables are defined in your `lsf.conf` file. See *'LSF Variables' on page 5* for more detailed information.

Step 5 Run the following program:

```
lsadmin reconfig
```

The license file is reread and the changes accepted by LSF.

Adding a Product

This section describes the procedure for adding another product from the LSF suite to an existing installation of LSF. LSF products are described in the preface of this book.

The procedure replaces the installed binaries and the running daemons, and automatically updates your configuration files to support the new LSF product configuration, if necessary.

CAUTION!

> **All interactive jobs running under LSF will be killed. Make sure that the system is completely idle before adding a product.**

You should do a complete backup of your LSF binaries and configuration files before adding a product to LSF.

Step 1 Shut down all LSF daemons and make sure there are no currently running jobs.

Step 2 Copy the LSF configuration file to the distribution directory.

This means you should copy the `/etc/lsf.conf` file.

Step 3 Log in to an LSF server host as `root`.

Step 4 Change directory to the distribution directory you have created.

Step 5 Run the `./lsfsetup` command.

Step 6 Choose option 6, 'Install Additional Product(s)'.

A product selection menu is displayed.

Step 7 Select the product(s) you are going to add.

Remember that if you choose more than one, you must separate them with commas.

You are prompted to indicate where the configuration file (`lsf.conf`) is located.

Step 8 Specify the configuration file's location.

Step 9 The procedure now follows the standard `lsfsetup` installation procedure as described in *'Default Installation Procedures' on page 14* or *'Custom Installation Procedures' on page 24*. You should review the installation settings and modify them, if necessary, before installing the additional software.

Perform the procedure once for each host type. The `lsfsetup` command automatically upgrades the necessary portions of LSF for each host type.

Step 10 Restart the LSF daemons on all hosts.

A. Installation on AFS

Introduction

Installing LSF in AFS involves running the `lsfsetup` program from the standard LSF distribution, and then installing the additional LSF AFS distribution.

LSF manages user permission for NFS, AFS, and DFS accesses, so users can use LSF no matter what type of filesystem their files are stored on. The choice of installation directory for LSF does not affect user access to load sharing.

Pre-Installation

Before installing LSF, you need to choose the primary LSF administrator, and decide where to store the LSF configuration and executable files. Complete instructions for LSF installation are in *'Default Installation' on page 13* or *'Custom Installation' on page 23*. You may use either installation type before installing the LSF AFS distribution.

Choosing the LSF Administrator

The `root` account cannot be used as the primary LSF administrator if the LSF configuration files are to be stored in AFS, because in this case, the primary LSF administrator must be defined in AFS.

LSF Installation Directory

LSF Batch needs read/write access to the working directories under `LSB_SHAREDIR`, which contain the LSF Batch log files. Before running the `lsfsetup` program, you

have to decide where to store your `LSB_SHAREDIR`. It can be stored locally, on an NFS-mounted filesystem, or on an AFS filesystem.

LSB_SHAREDIR on an AFS Filesystem

`LSB_SHAREDIR` should be defined in AFS only if the potential master hosts are trusted. The LSF system elects the master host in the order that the hosts appear in the `lsf.cluster.`*`cluster`* file. The first host is the default master. If the first host is down, the second host takes over as master, and so on. *'Installing the LSF AFS Distribution'* gives additional information on configuring LSF to use `LSB_SHAREDIR` on AFS.

LSB_SHAREDIR on a Local Filesystem

If you install the LSF Batch working directory in a local filesystem on one host, only that host can act as the LSF master. You must list this host first in the `lsf.cluster.`*`cluster`* file. If this host goes down, LSF Batch becomes unavailable. Batch processing resumes when the master host becomes available again. Interactive load sharing is still available while the host is down.

LSB_SHAREDIR on an NFS Filesystem

With this setup, the master daemon can be run on the hosts that have this directory mounted.

Additional Notes

You must not define `LSF_RES_ACCTDIR` and `LSF_LOGDIR` to be in AFS as the files in this directory are always written as the root user.

The other configuration directories are accessed read-only by the LSF daemons and thus can be defined in AFS if the ACL for these directories contain `system:any_user rl`.

Installing LSF

Follow the instructions in *'Default Installation' on page 13* or *'Custom Installation' on page 23* to install the standard LSF distribution. If some of your directories are defined in AFS, you must `klog` as the primary LSF administrator before running `lsfsetup`.

After Installing LSF

After running the `lsfsetup` program, add the following line to the `lsf.conf` file (stored in LSF_TOP/`etc` by default):

LSF_AFS_CELLNAME=*cell_name*

At this point, you can create @sys symbolic links so that `LSF_BINDIR`, `LSF_LIBDIR`, and `LSF_SERVERDIR` access the corresponding architecture directory.

Installing the LSF AFS Distribution

This LSF AFS distribution is named depending on the LSF version and host type, for example `lsf3.2_solaris_afs.tar.Z`.

Step 1 Get the additional LSF AFS tar distribution file from tape or downloaded from Platform Computing's WWW or FTP sites. Uncompress the compressed tar distribution file.

Step 2 Copy the following executables from the LSF AFS distribution directory to the `LSF_SERVERDIR` directory:

res sbatchd

These executables are the same as the ones in the main distribution except that they are linked with AFS libraries.

gettok puttok

gettok gets the AFS token(s) from the kernel and prints out the tokens in ASCII format to standard output. puttok reads the AFS token(s) in the format generated by gettok, from standard input and sets the token(s) into the kernel.

esub eexec

These are shell scripts invoked by LSF to support token forwarding from the submission host to the execution host, and for supporting token renewal. Sites can modify these scripts to further customize token processing (for example, using site-specific encryption software).

Step 3   If LSB_SHAREDIR is defined in AFS, the master batch daemon, mbatchd, must be configured so that it has the AFS token to write to LSB_SHAREDIR. The mbatchd.sc wrapper script in the LSF AFS distribution directory provides two methods for renewing the AFS token for the master batch daemon—plaintext password, and rtok daemon.

Plaintext Password

This method involves storing the primary LSF administrator's plaintext AFS password in a local file on the hosts that potentially can become the master.

- Rename mbatchd in LSF_SERVERDIR to mbatchd.real.
- Edit mbatchd.sc shell script in the AFS distribution directory:
    - Set LSF_ADMIN to the name of LSF primary administrator.
    - Set RTYPE=1
    - Set PWFILE to the absolute path of the file containing the plaintext password. This file should be accessible only by root.
- Copy mbatchd.sc to LSF_SERVERDIR as mbatchd.

rtok Daemon

This method involves setting up the token renewal daemon on the AFS server.

- Rename mbatchd in LSF_SERVERDIR to mbatchd.real.
- Set up token renewal kit as described in *'AFS Token Renewal Kit' on page 103.*

- Edit the `mbatchd.sc` shell script in the AFS distribution directory:

    - Set `LSF_ADMIN` to the name of LSF primary administrator.

    - Set `RTYPE=2`

    - Set `RTOKD_HOST` to the AFS server host name running `rtokd`.

    - Set `RTOK_PORT` to `rtokd`'s port number.

    - If PGP is used, follow the procedure described in *'AFS Token Encryption'* (below) to set up PGP for root on the potential master hosts, and on the AFS server host.

- Copy `mbatchd.sc` to `LSF_SERVERDIR` as `mbatchd`.

Step 4 If privileged port authentication is used and `LSF_BINDIR` is defined in AFS, you will need to change the ownership of the setuid executables in `LSF_BINDIR` to root. First, find all the binaries in `LSF_BINDIR` that are installed with the setuid bit on:

```
% ls -l | grep rws
```

Then `klog` to a user ID with AFS administrator privileges, and run:

```
% chown root setuid_binaries
```

Alternatively, you can simply `chown` all the LSF binaries under `LSF_BINDIR` to root if the directory contains only LSF binaries:

```
% chown root *
```

AFS Token Encryption

By default, the AFS `esub` and `eexec` scripts do not use encryption when transferring the AFS tokens between the submission and execution hosts. A site can modify these scripts to add site-specific encryption. The `esub` and `eexec` scripts in the LSF AFS distribution give an example of how to use PGP for encryption.

To configure LSF to use PGP:

Step 1 Install the PGP package on all LSF hosts.

A   Installation on AFS

Step 2 Define `LSF_EEXEC_USER=root` in `/etc/lsf.sudoers` on all LSF server hosts.

Step 3 Create the root account's PGP directory on all the LSF server hosts. This *root_pgp_dir* (for example, `/local/etc/.pgp`) should be a local directory and only be accessible by root.

Step 4 On an LSF server host, create root's public key and private keys by running (using Bourne shell syntax):

```
% PGPPATH=root_pgp_dir
% export PGPPATH
% pgp -kg lsf_pgp_name
```

where *lsf_pgp_name* can be any name you choose; for example,

```
% PGPPATH=/local/etc/.pgp
% export PGPPATH
% pgp -kg lsf
```

Step 5 Store the plain text pass phrase into `$PGPPATH/.p`. Make sure this file is owned by root and accessible only by root.

Extract the public key to a share file so users from any LSF host can access the file on encryption:

```
% pgp -kx lsf_pgp_name lsf_public_key_file
```

For example:

```
% pgp -kx lsf /usr/local/lsf/conf/lsfpublic.pgp
```

Step 6 Securely replicate the `PGPPATH` contents onto all the other LSF server hosts.

Step 7 Edit the `eexec` script, and

- Re-define `ROOT_PGPPATH` to your *root_pgp_dir* directory if necessary.
- Define `PGP_EXEC_PATH` to point to the directory containing the `pgp` executable.
- Remove the line: `PGPPATH=""`

Step 8 Edit the `esub` script, and re-define `LSF_PGP_NAME` to your *lsf_pgp_name* definition.

Step 9 Each LSF user who wants to use PGP encryption must do the following setup:

- Set up PGP by running pgp -kg. Make sure the PGPPATH environment variable is set.

- Add *lsf_pgp_name*'s public key to his/her public key ring by running:

    ```
    % pgp -ka user_name lsf_public_key_file
    ```

    For example, the user john would run,

    ```
    % pgp -ka john /usr/local/lsf/conf/lsfpublic.pgp
    ```

AFS Token Renewal Kit

The AFS token renewal kit in the LSF AFS distribution assumes that root is trusted on all the LSF server hosts. Since the token renewal kit uses the esub/eexec mechanism, a site can write its own token renewal system if a higher level of security is required.

The token renewal kit consists of a client program, rtok, and a server program, rtokd. rtok is used to request the rtokd daemon running on the AFS server host to renew the token for a user. rtok/rtokd also uses the eexec, esub, gettok, and puttok executables from the AFS distribution.

Setup on the AFS server host

If the AFS server host is of a host type that is not in your LSF cluster then you will need to get the LSF AFS distribution for that platform.

The assumption here is that the AFS server host is not part of the LSF cluster, and that none of the LSF binaries (in particular LSF_SERVERDIR) are accessible.

Define a directory to store the rtokd, gettok, puttok, eexec, and esub executables from the AFS distribution. If PGP is used, be sure to make the necessary modification to the esub script as described in *'AFS Token Encryption' on page 101*.

Set up a *client_hostsfile* file containing the list of machines that are authorized to renew tokens. This file is in the same format as /etc/hosts.

As root, start the rtokd server:

```
% absolute_path/rtokd -l /tmp -p portno client_hostsfile &
```

where

-l /tmp indicates that the messages are logged to /tmp/rtokd.log.*hostname*. If -l is not given, the messages are printed to standard error. If -l syslog is given, the messages are logged to syslog.

-p portno indicates the port number to which the daemon will listen for client requests.

client_hostfile is the path name of the file containing the addresses/names of the hosts, which are authorized to renew tokens.

By default, rtokd reads /usr/afs/db/kaserver.DB0 for the user's DES keys. If kaserver.DB0 is in another location, the full path can be specified using the -f option.

Add rtokd to the system startup file (for example, rc.local).

Setup on LSF Server Hosts

Step 1 Copy the rtokd, gettok, esub, puttok, eexec, and rtok executables into the LSF_SERVERDIR directory as defined in your lsf.conf file.

Step 2 Set the owner of rtok to root, and its permissions to 0700.

Step 3 Define LSF_EEXEC_USER=root in the /etc/lsf.sudoers file.

Step 4 If PGP is used, follow the instructions in *'AFS Token Encryption' on page 101* on how to modify the esub and eexec scripts to support encryption.

Step 5 Edit the eexec script to set RTOK_PORT to the rtokd's port number, and set RTOKD_HOST to the name of the AFS server host running rtokd.

B. Installation on DCE/DFS

Introduction

Installing LSF in DCE/DFS involves running the `lsfsetup` program from the main LSF distribution, and then installing the additional LSF DCE distribution.

Pre-Installation

Before installing, you need to choose the primary LSF administrator, and decide where to store the LSF configuration and executable files.

Choosing the LSF Administrator

The `root` account cannot be used as the primary LSF administrator if the LSF configuration files are to be stored in DFS, because in this case, the primary LSF administrator must be defined in DCE.

LSF Installation Directory

The master batch daemon needs read/write access to the working directories under `LSB_SHAREDIR`, which contain the LSF Batch log files. Since the daemon is not authenticated to DCE, you must not define `LSB_SHAREDIR` to be in DFS when running `lsfsetup`. The other configuration files are accessed read-only by the LSF daemons and thus can be defined in DFS if the ACL for these directories contains `any_other:r-----`. Similarly, the LSF executables can be stored in DFS if the ACL contains `any_other:r-x---`.

Additional Notes

You must not define `LSF_RES_ACCTDIR` and `LSF_LOGDIR` to be in DFS because the files in this directory are always written by the root user ID.

Installing LSF

Follow the instructions in *'Default Installation' on page 13* or *'Custom Installation' on page 23* to install the main LSF distribution. If some of your directories are defined in DFS, you must `dce_login` as the primary LSF administrator before running `lsfsetup`.

You may use either installation procedure to install LSF before installing the additional LSF DCE distribution.

After Installing LSF

At this point, you can create @sys symbolic links so that `LSF_BINDIR`, `LSF_LIBDIR`, and `LSF_SERVERDIR` access the corresponding architecture directories.

Installing the LSF DCE Distribution

This distribution is named depending on the LSF version and host type, for example `lsf3.2_solaris_dce.tar.Z`.

Step 1   Get the LSF DCE tar distribution file from tape or from downloaded from Platform Computing's WWW or FTP sites. Uncompress the compressed distribution file.

Step 2 Copy the following executables from the LSF DCE distribution directory to the
LSF_SERVERDIR directory:

daemons.wrap (res sbatchd)
These executables are compiled with DCE/DFS support. After copying them
to the LSF_SERVERDIR directory, rename the original files and make the
following links:
mv res res.real
mv sbatchd sbatchd.real
ln -s daemons.wrap res
ln -s daemons.wrap sbatchd

getcrd putcrd

getcrd gets the DCE credentials from the credential cache and outputs the
tokens to standard output. putcrd reads from the standard input the AFS
token(s) in the format generated by getcrd, and sets the credentials for the
invoker.

esub eexec

These are shell scripts invoked by LSF to support credential forwarding from
the submission host to the execution host. Sites can modify these scripts to
further customize credential processing (for example, using site-specific
encryption software).

Step 3 If privileged port authentication is used (i.e., LSF_AUTH is not defined in your
lsf.conf file when you run lsfsetup), and LSF_BINDIR is defined in DFS,
you will need to change the ownership of the setuid executables in
LSF_BINDIR to root. First, find all the binaries in LSF_BINDIR that are
installed with the setuid bit on:

% **ls -l | grep rws**

Then dce_login to the primary LSF administrator, and use the command
cm setsetuid:

% **cm setsetuid -path setuid_binaries -state on**

Credential Encryption

By default, the DCE `esub` and `eexec` scripts do not use encryption when transferring the DCE credentials between the submission and execution hosts. A site can modify these scripts to add site-specific encryption. The `esub` and `eexec` scripts in the LSF DCE distribution give an example of how to use PGP for encryption. To configure LSF to use PGP, follow the instructions in *'AFS Token Encryption' on page 101*.

C. License Reference

LSF License Management

LSF software is licensed using the FLEXlm license manager from Globetrotter Software, Inc. The LSF license key controls the hosts allowed to run LSF. The procedures for obtaining, installing and upgrading license keys are described in *'Getting License Key Information' on page 34* and *'Setting Up the License Key' on page 36*. This section provides background information on FLEXlm.

FLEXlm controls the total number of hosts configured in all your LSF clusters. You can organize your hosts into clusters however you choose. Each server host requires at least one license; multiprocessor hosts require more than one, as a function of the number of processors. Each client host requires 1/5 of a license.

LSF uses two kinds of FLEXlm license: time-limited DEMO licenses and permanent licenses.

The DEMO license allows you to try LSF out on an unlimited number of hosts on any supported host type. The trial period has a fixed expiry date, and the LSF software will not function after that date. DEMO licenses do not require any additional daemons.

Permanent licenses are the most common. A permanent license limits only the total number of hosts that can run the LSF software, and normally has no time limit. You can choose which hosts in your network will run LSF, and how they are arranged into clusters. Permanent licenses are counted by a license daemon running on one host on your network.

For permanent licenses, you need to choose a license server host and send hardware host identification numbers for the license server host to your software vendor. The vendor uses this information to create a permanent license that is keyed to the license server host. Some host types have a built-in hardware host ID; on others, the hardware address of the primary LAN interface is used.

How FLEXlm Works

FLEXlm is used by many UNIX software packages because it provides a simple and flexible method for controlling access to licensed software. A single FLEXlm license server can handle licenses for many software packages, even if those packages come from different vendors. This reduces the systems administration load, since you do not need to install a new license manager every time you get a new package.

The License Server Daemon

FLEXlm uses a daemon called `lmgrd` to manage permanent licenses. This daemon runs on one host on your network, and handles license requests from all applications. Each license key is associated with a particular software vendor. `lmgrd` automatically starts a *vendor daemon*; the LSF version is called `lsf_ld` and is provided by Platform Computing Corporation. The vendor daemon keeps track of all licenses supported by that vendor. DEMO licenses do not require you to run license daemons.

The license server daemons should be run on a reliable host, since licensed software will not run if it cannot contact the license server. The FLEXlm daemons create very little load, so they are usually run on the file server. If you are concerned about availability, you can run `lmgrd` on a set of three or five hosts. As long as a majority of the license server hosts are available, applications can obtain licenses.

The License File

Software licenses are stored in a text file. The default location for this file is `/usr/local/flexlm/licenses/license.dat`, but this can be overridden. The license file must be readable on every host that runs licensed software. It is most convenient to place the license file in a shared NFS directory.

The `license.dat` file normally contains:

- A `SERVER` line for each FLEXlm server host. The `SERVER` line contains the host name, hardware host ID and network port number for the server.

- A `DAEMON` line for each software vendor, which gives the file path name of the vendor daemon.

- A `FEATURE` line for each software license. This line contains the number of copies that may be run, along with other necessary information.

The `FEATURE` line contains an encrypted code to prevent tampering. For permanent licenses, the licenses granted by the `FEATURE` line can be accessed only through license servers listed on the `SERVER` lines.

For DEMO licenses no FLEXlm daemons are needed, so the license file contains only the `FEATURE` line.

Here is an example of a DEMO license file. This file contains one line for each separate product (see *'Modifying LSF Products and Licensing' on page 113*). However, no `SERVER` or `DAEMON` information is needed. The license is for LSF 3.1 and is valid until Jun. 10, 1998.

```
FEATURE lsf_base lsf_ld 3.100 10-Jun-1998 0 5C51F231E238555BAD7F "Platform" DEMO
FEATURE lsf_batch lsf_ld 3.100 10-Jun-1998 0 6CC1D2C137651068E23C "Platform" DEMO
FEATURE lsf_multicluster lsf_ld 3.100 10-Jun-1998 0 2CC1F2E132C85B8D1806 "Platform" DEMO
```

The following is an example of a permanent license file. The license server is configured to run on *hostD*, using TCP port 1700. This allows 10 hosts to run LSF, with no expiry date.

```
SERVER hostD 08000962cc47 1700
DAEMON lsf_ld /usr/local/lsf/etc/lsf_ld
FEATURE lsf_base lsf_ld 3.100 01-Jan-0000 0 51F2315CE238555BAD7F "Platform"
FEATURE lsf_batch lsf_ld 3.100 01-Jan-0000 0 C1D2C1376C651068E23C "Platform"
FEATURE lsf_multicluster lsf_ld 3.100 01-Jan-0000 0 C1F2E1322CC85B8D1806 "Platform"
```

License Management Utilities

FLEXlm provides several utility programs for managing software licenses. These utilities and their manual pages are included in the LSF software distribution.

Because these utilities can be used to shut down the FLEXlm license server, and thus prevent licensed software from running, they are installed in the `LSF_SERVERDIR` directory. The file permissions are set so that only root and members of group 0 can use them.

The utilities included are:

lmcksum
> Calculate check sums of the license key information

lmdown
> Shut down the FLEXlm server

lmhostid
> Display the hardware host ID

lmremove
> Remove a feature from the list of checked out features

lmreread
> Tell the license daemons to re-read the license file

lmstat
> Display the status of the license servers and checked out licenses

lmver
> Display the FLEXlm version information for a program or library

For complete details on these commands, see the on-line manual pages.

Updating an LSF License

FLEXlm only accepts one license key for each feature listed in a license key file. If there is more than one FEATURE line for the same feature, only the first FEATURE line is used. To add hosts to your LSF cluster, you must replace the old FEATURE line with a new one listing the new total number of licenses.

The procedure for updating a license key file to include new license keys is described in *'Adding a Permanent License' on page 40*.

Changing the FLEXlm Server TCP Port

The fourth field on the SERVER line specifies the TCP port number that the FLEXlm server uses. Choose an unused port number. LSF usually uses port numbers in the range 3879 to 3882, so the numbers from 3883 on are good choices. If the lmgrd daemon complains that the license server port is in use, you can choose another port number and restart lmgrd.

For example, if your license file contains the line:

SERVER *hostname* *host-id* 1700

and you want your FLEXlm server to use TCP port 3883, change the SERVER line to:

SERVER *hostname* *host-id* 3883

Modifying LSF Products and Licensing

The configuration changes to enable a particular product in a cluster are handled during installation by `lsfsetup`. If at some later time you want to modify the products of your cluster, edit the PRODUCTS line in the 'Parameters' section of the `lsf.cluster.cluster` file. You can specify any combination of the strings 'LSF_Base', 'LSF_Batch', 'LSF_JobScheduler', 'LSF_Analyzer', 'LSF_MultiCluster' and 'LSF_Parallel' to enable the operation of LSF Base, LSF Batch, LSF JobScheduler, LSF Analyzer, LSF MultiCluster, and LSF Parallel, respectively. If any of 'LSF_Batch', 'LSF_JobScheduler', or 'LSF_MultiCluster' are specified, then 'LSF_Base' is automatically enabled as well.

If the `lsf.cluster.cluster` file is shared, adding a product name to the PRODUCTS line enables that product for all hosts in the cluster. For example, enable the operation of LSF Base, LSF Batch and LSF MultiCluster:

```
Begin Parameters
PRODUCTS=LSF_Batch LSF_MultiCluster
End Parameters
```

Enable the operation of LSF Base only:

```
Begin Parameters
PRODUCTS=LSF_Base
End Parameters
```

Enable the operation of LSF JobScheduler:

```
Begin Parameters
PRODUCTS=LSF_JobScheduler
End Parameters
```

Selected Hosts

It is possible to indicate that only certain hosts run LSF Batch or LSF JobScheduler within a cluster. This is done by specifying 'LSF_Batch' or 'LSF_JobScheduler' in the RESOURCES field on the HOSTS section of the lsf.cluster.*cluster* file. For example, the following enables hosts *hostA*, *hostB*, and *hostC* to run LSF JobScheduler and hosts *hostD*, *hostE*, and *hostF* to run LSF Batch.

```
Begin Parameters
PRODUCTS=LSF_Batch
End Parameters

Begin   Host
HOSTNAME     model      type        server    RESOURCES
hostA        SUN41      SPARCSLC    1         (sparc bsd lsf_js)
hostB        HPPA9      HP735       1         (linux lsf_js)
hostC        SGI        SGIINDIG    1         (irix cs lsf_js)
hostD        SUNSOL     SunSparc    1         (solaris)
hostE        HP_UX      A900        1         (hpux cs bigmem)
hostF        ALPHA      DEC5000     1         (alpha)
End Hosts
```

The license file used to serve the cluster must have the corresponding features. A host will show as unlicensed if the license for the product it was configured to run is unavailable. For example, if a cluster is configured to run LSF JobScheduler on all hosts, and the license file does not contain the LSF JobScheduler feature, than the hosts will be unlicensed, even if there are licenses for LSF Base or LSF Batch.

D. LSF Directories

This table lists the directories used by the LSF system, their modes and contents.

Table 1. LSF Directories

Directory	Mode	Contents
`$LSB_CONFDIR` `$LSB_CONFDIR/*`	755	LSF Batch configuration files, must be owned by the primary LSF administrator, and shared by all potential master hosts
`$LSB_SHAREDIR/` *cluster*`/logdir`	755	LSF Batch accounting files, must be owned by the primary LSF administrator, and shared by all potential master hosts
`$LSF_BINDIR`	755	User commands, must allow setuid to root, shared by all hosts of the same type
`$LSF_CONFDIR`	755	LSF cluster configuration files, must be owned by the primary LSF administrator, and shared by all LSF server hosts
`$LSF_ENVDIR`	755	`lsf.conf` file, must be owned by root
`$LSF_INCLUDEDIR`	755	Header files `lsf/lsf.h` and `lsf/lsbatch.h`
`$LSF_INDEP`	755	Host type independent files shared by all hosts
`$LSF_LIBDIR`	755	LSF libraries, shared by all hosts of the same type
`$LSF_LOGDIR`	777	Server error logs, must be owned by root
`$LSF_MACHDEP`	755	Host type dependent files shared by all hosts of the same type
`$LSF_MANDIR`	755	LSF `man` pages shared by all hosts

D   LSF Directories

Table 1. LSF Directories

Directory	Mode	Contents
`$LSF_MISC`	755	Examples and other miscellaneous files shared by all hosts
`$LSF_SERVERDIR`	755	Server binaries, must be owned by root, and shared by all hosts of the same type
`$XLSF_APPDIR`	755	Window application resource files, shared by all hosts
`$XLSF_UIDDIR`	755	GUI UID files, shared by all hosts of the same type

E. Host Naming

Introduction

LSF needs to match host names with the corresponding Internet host addresses. Host names and addresses can be looked up in the `/etc/hosts` file, Sun's Network Information System/Yellow Pages (NIS or YP), or the Internet Domain Name Service (DNS). DNS is also known as the Berkeley Internet Name Domain (BIND) or `named`, which is the name of the BIND daemon. Each UNIX host is configured to use one or more of these mechanisms.

Each host has one or more network addresses; usually one for each network to which the host is directly connected. Each host can also have more than one name. The first name configured for each address is called the *official name*; other names for the same host are called *aliases*.

LSF uses the configured host naming system on each host to look up the official host name for any alias or host address. This means that you can use aliases as input to LSF, but LSF always displays the official name.

On Digital Unix systems, the `/etc/svc.conf` file controls which name service is used. On Solaris systems, the `/etc/nsswitch.conf` file controls the name service. On other hosts, the following rules apply:

- If your host has an `/etc/resolv.conf` file, your host is using DNS for name lookups

- If the command `ypcat hosts` prints out a list of host addresses and names, your system is looking up names in NIS

- Otherwise, host names are looked up in the `/etc/hosts` file

E   Host Naming

The manual pages for the `gethostbyname` function, the `ypbind` and `named` daemons, the `resolver` functions, and the `hosts`, `svc.conf`, `nsswitch.conf`, and `resolv.conf` files explain host name lookups in more detail.

Hosts with Multiple Addresses

Hosts which have more than one network interface usually have one Internet address for each interface. Such hosts are called *multi-homed hosts*. LSF identifies hosts by name, so it needs to match every one of these addresses with a single host name. To do this, the host name information must be configured so that all of the Internet addresses for a host resolve to the same name.

Some system manufacturers recommend that each network interface, and therefore, each Internet address, be assigned a different host name. Each interface can then be directly accessed by name. This setup is often used to make sure NFS requests go to the nearest network interface on the file server, rather than going through a router to some other interface. Configuring this way can confuse LSF, because there is no way to determine that the two different names (or addresses) mean the same host. LSF provides a workaround for this problem.

All host naming systems can be configured so that host address lookups always return the same name, while still allowing access to network interfaces by different names. Each host has an official name and a number of aliases, which are other names for the same host. By configuring all interfaces with the same official name but different aliases, you can refer to each interface by a different alias name while still providing a single official name for the host.

Here are examples of `/etc/hosts` entries. The first example is for a host with two interfaces, where the host does not have a unique official name.

```
# Address          Official name      Aliases
# Interface on network A
AA.AA.AA.AA        host-AA.domain     host.domain host-AA host
# Interface on network B
BB.BB.BB.BB        host-BB.domain     host-BB host
```

Looking up the address `AA.AA.AA.AA` finds the official name `host-AA.domain`. Looking up address `BB.BB.BB.BB` finds the name `host-BB.domain`. No information connects the two names, so there is no way for LSF to determine that both names, and both addresses, refer to the same host.

Here is the same example, with both addresses configured for the same official name.

```
# Address           Official name    Aliases
# Interface on network A
AA.AA.AA.AA        host.domain      host-AA.domain host-AA host
# Interface on network B
BB.BB.BB.BB        host.domain      host-BB.domain host-BB host
```

With this configuration, looking up either address returns `host.domain` as the official name for the host. LSF (and all other applications) can determine that all the addresses and host names refer to the same host. Individual interfaces can still be specified by using the `host-AA` and `host-BB` aliases.

Sun's NIS uses the `/etc/hosts` file on the NIS master host as input, so the format for NIS entries is the same as for the `/etc/hosts` file.

The configuration format is different for DNS. The same result can be produced by configuring two address (A) records for each Internet address. Following the previous example:

```
# name            class  type address
host.domain        IN     A     AA.AA.AA.AA
host.domain        IN     A     BB.BB.BB.BB
host-AA.domain     IN     A     AA.AA.AA.AA
host-BB.domain     IN     A     BB.BB.BB.BB
```

Looking up the official host name can return either address. Looking up the interface-specific names returns the correct address for each interface.

Address-to-name lookups in DNS are handled using PTR records. The PTR records for both addresses should be configured to return the official name:

```
# address                  class  type  name
AA.AA.AA.AA.in-addr.arpa   IN     PTR   host.domain
BB.BB.BB.BB.in-addr.arpa   IN     PTR   host.domain
```

If it is not possible to change the system host name database, you can create a hosts file local to the LSF system. This file only needs to have entries for multi-homed hosts. Host

E   Host Naming

names and addresses not found in this file are looked up in the standard name system on your host.

F. LSF and NQS

This chapter contains information on registering LSF with the Network Queuing System.

Configuring NQS Interoperation

NQS (Network Queuing System) is a UNIX batch queuing facility that allows users to queue batch jobs to individual UNIX hosts from remote systems. This chapter describes how to configure and use LSF to submit and control batch jobs in NQS queues.

If you are not going to configure LSF to interoperate with NQS, you do not need to read this chapter.

While it is desirable to run LSF on all hosts for transparent resource sharing, this is not always possible. Some of the computing resources may be under separate administrative control, or LSF may not currently be available for some of the hosts.

An example of this is sites that use Cray supercomputers. The supercomputer is often not under the control of the workstation system administrators. Users on the workstation cluster still want to run jobs on the Cray supercomputer. LSF allows users to submit and control jobs on the Cray system using the same interface as they use for jobs on the local cluster.

LSF queues can be configured to forward jobs to remote NQS queues. Users can submit jobs, send signals to jobs, check the status of jobs, and delete jobs that are forwarded to the remote NQS. Although running on an NQS server outside the LSF cluster, jobs are still managed by LSF Batch in almost the same way as jobs running inside the LSF cluster.

F   LSF and NQS

Registering LSF with NQS

This section describes how to configure LSF and NQS so that jobs submitted to LSF can be run on NQS servers. To do this, you should already be familiar with the administration of the NQS system.

Hosts

NQS uses a machine identification number (MID) to identify each NQS host in the network. The MID must be unique and must be the same in the NQS database of each host in the network. LSF uses the NQS protocol to talk with NQS daemons for routing, monitoring, signalling and deleting LSF Batch jobs that run on NQS hosts. Therefore, you must assign a MID to each of the LSF hosts that might become the master host.

To do this, perform the following steps:

Step 1   Login to the NQS host as the NQS System Administrator or System Operator.

Step 2   Run the `nmapmgr` command to create MIDs for each LSF host that can possibly become the master host. List all MIDs available. See the NQS `nmapmgr(1)` manual page for a description of this command.

Users

NQS uses a mechanism similar to `ruserok(3)` to determine whether access is permitted. When a remote request from LSF is received, NQS looks in the `/etc/hosts.equiv` file. If the submitting host is found, requests are allowed as long as the user name is the same on both hosts. If the submitting host is not listed in the `/etc/hosts.equiv` file, NQS looks for a `.rhosts` file in the destination user's home directory. This file must contain the names of both the submitting host and the submitting user. Finally, if access still is not granted, NQS checks for a file called `/etc/hosts.nqs`. This file is similar to the `.rhosts` file, but it can provide mapping of remote usernames to local usernames. Cray NQS also looks for a `.nqshosts` file in the destination user's home directory. The `.nqshosts` file has the same format as the `.rhosts` file.

NQS treats the LSF cluster just as if it were a remote NQS server, except that jobs never flow to the LSF cluster from NQS hosts.

For LSF users to get permission to run jobs on NQS servers, you must make sure the above setup is done properly. Refer to your local NQS documentation for details on setting up the NQS side.

lsb.nqsmaps

The `lsb.nqsmaps` file in the `LSB_CONFDIR/`*cluster*`/configdir` directory is for configuring inter-operation between LSF and NQS.

Hosts

LSF must use the MIDs of NQS hosts when talking with NQS servers. The `Hosts` section of the `LSB_CONFDIR/`*cluster*`/configdir/lsb.nqsmaps` file contains the MIDs and operating system types of your NQS hosts.

```
Begin Hosts
HOST_NAME       MID     OS_TYPE
cray001         1       UNICOS      #NQS host, must specify OS_TYPE
sun0101         2       SOLARIS     #NQS host
sgi006          3       IRIX        #NQS host
hostA           4       -           #LSF host; OS_TYPE is ignored
hostD           5       -           #LSF host
hostB           6       -           #LSF host
End Hosts
```

Note that the `OS_TYPE` column is required for NQS hosts only. For hosts in the LSF cluster, `OS_TYPE` is ignored; the type is specified by the `TYPE` field in the `lsf.cluster.`*cluster* file. The '-' entry is a placeholder.

User Name Mapping

LSF assumes that users have the same account names and user IDs on all LSF hosts. If the user accounts on the NQS hosts are not the same as on the LSF hosts, the LSF administrator must specify the NQS usernames that correspond to LSF users.

The `Users` section of the `lsb.nqsmaps` file contains entries for LSF users and the corresponding account names on NQS hosts. The following example shows two users who have different accounts on the NQS server hosts.

```
Begin Users
FROM_NAME       TO_NAME
user7           (user7l@cray001 luser7@sgi006)
user4           (suser4@cray001)
End Users
```

`FROM_NAME` is the user's login name in the LSF cluster, and `TO_NAME` is a list of the user's login names on the remote NQS hosts. If a user is not specified in the `lsb.nqsmaps` file, jobs are sent to the NQS hosts with the same user name.

Configuring Queues for NQS Jobs

You must configure one or more LSF Batch queues to forward jobs to remote NQS hosts. A forward queue is an LSF Batch queue with the parameter `NQS_QUEUES` defined. The following queue forwards jobs to the NQS queue named `pipe` on host `cray001`:

```
Begin Queue
QUEUE_NAME  = nqsUse
PRIORITY    = 30
NICE        = 15
QJOB_LIMIT  = 5
UJOB_LIMIT  = ()
CPULIMIT    = 15
NQS_QUEUES  = pipe@cray001
DESCRIPTION = Jobs submitted to this queue are forwarded to NQS_QUEUES
USERS       = all
End Queue
```

You can specify more than one NQS queue for the `NQS_QUEUES` parameter. LSF Batch tries to send the job to each queue in the order they are listed, until one of the queues accepts the job.

Since many features of LSF are not supported by NQS, the following queue configuration parameters are ignored for NQS forward queues: `PJOB_LIMIT`, `POLICIES`, `RUN_WINDOW`, `DISPATCH_WINDOW`, `RUNLIMIT`, `HOSTS`, `MIG`. In addition,

scheduling load threshold parameters are ignored because NQS does not provide load information about hosts.

Handling Cray NQS Incompatibilities

Cray NQS is incompatible with some of the public domain versions of NQS. Different versions of NQS on Cray may be incompatible with each other. If your NQS server host is a Cray, some additional steps may be needed in order for LSF to understand the NQS protocol correctly.

If the NQS version on a Cray is NQS 80.42 or NQS 71.3, then no extra setup is needed. For other versions of NQS on a Cray, you need to define NQS_REQUESTS_FLAGS and NQS_QUEUES_FLAGS in the lsb.params file.

NQS_REQUESTS_FLAGS = *integer*

If the version is NQS 1.1 on a Cray, the value of this flag is 251918848.

For other versions of NQS on a Cray, do the following to get the value for this flag. Run the NQS command:

```
% qstat -h CrayHost -a
```

on a workstation, where CrayHost is the host name of the Cray machine. Watch the messages logged by Cray NQS (you need access to the NQS log file on the Cray host):

```
03/02 12:31:59 I pre_server(): Packet type=<NPK_QSTAT(203)>.
03/02 12:31:59 I pre_server(): Packet contents are as follows:
03/02 12:31:59 I pre_server(): Npk_str[1] = <>.
03/02 12:31:59 I pre_server(): Npk_str[2] = <platform>.
03/02 12:31:59 I pre_server(): Npk_int[1] = <1392767360>.
03/02 12:31:59 I pre_server(): Npk_int[2] = <2147483647>.
03/02 12:31:59 I show_qstat_flags(): Flags=SHO_R_ALLUID SHO_R_SHORT
SHO_RS_RUN SHO_RS_STAGE SHO_RS_QUEUED SHO_RS_WAIT SHO_RS_HOLD \
    SHO_RS_ARRIVE SHO_Q_BATCH SHO_Q_PIPE SHO_R_FULL SHO_R_HDR
```

The value of Npk_int[1] in the above output is the value you need for the parameter NQS_REQUESTS_FLAGS.

NQS_QUEUES_FLAGS = *integer*

To get the value for this flag, run the NQS command:

```
% qstat -h CrayHost -p -b -l
```

on a workstation, where `CrayHost` is the host name of the Cray machine. Watch the messages logged by Cray NQS (you need to have access to the Cray NQS log file):

```
03/02 12:32:57 I pre_server(): Packet type=<NPK_QSTAT(203)>.
03/02 12:32:57 I pre_server(): Packet contents are as follows:
03/02 12:32:57 I pre_server(): Npk_str[1] = <>.
03/02 12:32:57 I pre_server(): Npk_str[2] = <platform>.
03/02 12:32:57 I pre_server(): Npk_int[1] = <593494199>.
03/02 12:32:57 I pre_server(): Npk_int[2] = <2147483647>.
03/02 12:32:57 I show_qstat_flags(): Flags=SHO_H_ACCESS SHO_H_DEST \
    SHO_H_LIM SHO H_RUNL SHO_H_SERV SHO_R_ALLUID SHO_Q_HDR \
    SHO_Q_LIMITS SHO_Q_BATCH SHO_Q_PIPE SHO_Q_FULL
```

The value of Npk_int[1] in the above output is the value you need for the parameter `NQS_QUEUES_FLAGS`.

If you are unable to get the required information after running the above NQS commands, make sure that your Cray NQS is configured properly to log these parameters. To do this, run:

```
% qmgr
```

and enter `show all` to get all information. The parameters related to the logging of the information you need are:

```
Debug level = 3
MESSAGE_Header = Short
MESSAGE_Types:
    Accounting          OFF     CHeckpoint          OFF     COMmand_flow OFF
    CONfig              OFF     DB_Misc             OFF     DB_Reads OFF
    DB_Writes           OFF     Flow                OFF     NETWORK_Misc ON
    NETWORK_Reads       ON      NETWORK_Writes      ON      OPer OFF
    OUtput              OFF     PACKET_Contents     ON      PACKET_Flow ON
    PROTOCOL_Contents   ON      PROTOCOL_Flow       ON      RECovery OFF
    REQuest             OFF     ROuting             OFF     Scheduling OFF
    USER1               OFF     USER2               OFF     USER3 OFF
    USER4               OFF     USER5               OFF
```

NQS Forward Queues

To interoperate with NQS, you must configure one or more LSF Batch queues to forward jobs to remote NQS hosts. An NQS forward queue is an LSF Batch queue with the parameter `NQS_QUEUES` defined.

```
NQS_QUEUES = queue_name@host_name ...
```

host_name is an NQS host name which can be the official host name or an alias name known to the LSF master host through `gethostbyname(3)`. *queue_name* is the name of an NQS queue on this host. NQS destination queues are considered for job routing in the order in which they are listed here. If a queue accepts the job, then it is routed to that queue. If no queue accepts the job, it remains pending in the NQS forward queue.

The `lsb.nqsmaps` file (see *'The lsb.nqsmaps File' on page 128*) must be present in order for LSF Batch to route jobs in this queue to NQS systems.

Since many features of LSF are not supported by NQS, the following queue configuration parameters are ignored for NQS forward queues: `PJOB_LIMIT`, `POLICIES`, `RUN_WINDOW`, `DISPATCH_WINDOW`, `RUNLIMIT`, `HOSTS`, `MIG`. In addition,

scheduling load threshold parameters are ignored because NQS does not provide load information about hosts.

Default: undefined.

```
DESCRIPTION = text
```

A brief description of the job queue. This information is displayed by the bqueues -l command. The description can include any characters, including white space. The description can be extended to multiple lines by ending the preceding line with a back slash '\'. The maximum length for the description is 512 characters.

This description should clearly describe the service features of this queue to help users select the proper queue for each job.

The `lsb.nqsmaps` File

The lsb.nqsmaps file contains information on configuring LSF for interoperation with NQS. This file is optional.

Hosts

NQS uses a machine identification number (MID) to identify each host in the network that communicates using the NQS protocol. This MID must be unique and must be the same in the NQS database of each host in the network. The MID is assigned and put into the NQS data base using the NQS program nmapmgr(1m) or Cray NQS command qmgr(8). mbatchd uses the NQS protocol to talk with NQS daemons for routing, monitoring, signalling, and deleting LSF Batch jobs that run on NQS hosts. Therefore, the MIDs of the LSF master host and any LSF host that might become the master host when the current master host is down must be assigned and put into the NQS database of each host which may possibly process LSF Batch jobs.

In the mandatory Hosts section, list the MIDs of the LSF master host (and potential master hosts) and the NQS hosts that are specified in the lsb.queues file. If an NQS destination queue specified in the lsb.queues file is a pipe queue, the MIDs of all the destination hosts of this pipe queue must be listed here. If a destination queue of this

pipe queue is itself a pipe queue, the MIDs of the destination hosts of this queue must also be listed, and so forth.

There are three mandatory keywords in this section:

`HOST_NAME`

The name of an LSF or NQS host. It can be the official host name or an alias host name known to the master batch daemon (`mbatchd`) through `gethostbyname`(3).

`MID`

The machine identification number of an LSF or NQS host. It is assigned by the NQS administrator to each host communicating using the NQS protocol.

`OS_TYPE`

The operating system (OS) type of the NQS host. At present, its value can be one of `ULTRIX`, `HPUX`, `AIX`, `SOLARIS`, `SUNOS`, `IRIX`, `OSF1`, `CONVEX` or `UNICOS`. It is used by `mbatchd` to deliver the correct signals to the LSF Batch jobs running on this NQS host. An incorrect OS type would cause unpredictable results. If the host is an LSF host, the type is specified by the `type` field of the `Host` section in the `lsf.cluster.cluster` file. `OS_TYPE` is ignored; '-' must be used as a placeholder.

```
Begin Hosts
HOST_NAME       MID    OS_TYPE
cray001         1      UNICOS      #NQS host, must specify OS_TYPE
sun0101         2      SOLARIS     #NQS host
sgi006          3      IRIX        #NQS host
hostA           4      -           #LSF host; OS_TYPE is ignored
hostD           5      -           #LSF host
hostC           6      -           #LSF host
End Hosts
```

Users

LSF assumes shared and uniform user accounts on all of the LSF hosts. However, if the user accounts on NQS hosts are not the same as on LSF hosts, account mapping is needed so that the network server on the remote NQS host can take on the proper

identity attributes. The mapping is performed for all NQS network conversations. In addition, the user name and the remote host name may need to match an entry either in the `.rhosts` file in the user's home directory, or in the `/etc/hosts.equiv` file, or in the `/etc/hosts.nqs` file on the server host. For Cray NQS, the entry may be either in the `.rhosts` file or in the `.nqshosts` file in the user's home directory.

This optional section defines the user name mapping from the LSF master host to each of the NQS hosts listed in the `Host` section above (i.e., the hosts on which the jobs routed by LSF Batch may run). There are two mandatory keywords:

`FROM_NAME`

The name of an LSF Batch user. It is a valid login name on the LSF master host.

`TO_NAME`

A list of user names on NQS hosts to which the corresponding `FROM_NAME` is mapped. Each of the user names is specified in the form *username*@*hostname*. The *hostname* is the official name or an alias name of an NQS host, while the *username* is a valid login name on this NQS host. The `TO_NAME` of a user on a specific NQS host should always be the same when the user's name is mapped from different hosts. If no `TO_NAME` is specified for an NQS host, LSF Batch assumes that the user has the same user name on this NQS host as on an LSF host.

```
Begin Users
FROM_NAME        TO_NAME
user3            (user3l@cray001 luser3@sgi006)
user1            (suser1@cray001) # assumed to be user1@sgi006
End Users
```

If a user is not specified in the `lsb.nqsmaps` file, jobs are sent to NQS hosts with the same name the user has in LSF.

G. UNIX/NT Mixed Clusters

The following points should be considered in a heterogeneous UNIX/NT environment.

- By default, LSF transfers environment variables from the submission to the execution host. However, some environment variables do not make sense when transferred. When submitting a job from Windows NT to a UNIX machine, the `-L` option of `bsub` can be used to reinitialize the environment variables. If submitting a job from a UNIX machine to an Windows NT machine, you can set the environment variables explicitly in your job script. Alternatively, a job starter can be used to reset the environment variables before starting the job.

  LSF automatically resets the `PATH` on the execution host if the submission host is of a different type. If the submission host is Windows NT and the execution host is UNIX, the `PATH` variable is set to `/bin:/usr/bin:/sbin:/usr/sbin` and `LSF_BINDIR` (if defined in `lsf.conf`) is appended to it. If the submission host is UNIX and the execution host is Windows NT, the `PATH` variable is set to the system `PATH` variable with `LSF_BINDIR` appended to it. LSF looks for the presence of the `WINDIR` variable in the job's environment to determine whether the job was submitted from an Windows NT or UNIX host. If `WINDIR` is present, it is assumed that the submission host was Windows NT, otherwise the submission host is assumed to be a UNIX machine.

- The `lssrvcntrl.exe` binary only works when invoked from a Windows NT machine. You will not be able to start up LSF daemons on a Windows NT machine from a UNIX machine. The converse is also true: you cannot start the LSF daemons on a UNIX machine from a Windows NT machine.

- The LSF configuration files have to be accessible from both the Windows NT and UNIX machines. You need to set up a shared file system between the UNIX and Windows NT machines via NFS client on Windows NT or a SMB server on UNIX.

  Alternatively, you can replicate the configuration files.

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